

SCIENCE

FRIDAY, JUNE 25, 1937

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Dedication of the New Building of Mellon Institute:	
Communication Engineering: DR. FRANK B. JEWETT	591
Early Work on Insulin: DR. F. G. BANTING	594
Obituary:	
J. P. Burrell: DR. J. S. PLASKETT. Recent Deaths	597
Scientific Events:	
The Linnean Society of London; St. Louis Meeting of the Eastern Section of the Seismological Society of America; The Proposed American Association of Applied Psychology; Marine Biological Laboratories; Awards of Latin American Fellowships by the Guggenheim Foundation	598
Scientific Notes and News	601
Discussion:	
Cobalt—an Essential Element in Animal Nutrition—Australian Investigations: DR. E. J. UNDERWOOD. A Possible Source of Laboratory Fires: DR. JULIAN H. LEWIS. "Hypothecate" versus "Assume": DR. A. V. HILL. William Morton Wheeler and the Classics: HENRY OSBORN TAYLOR	604
Scientific Books:	
Modern Physics: PROFESSOR V. F. LENZEN	606
Societies and Meetings:	
The North Carolina Academy of Science: DR. H. L. BLOMQUIST	607

Special Articles:

The Effects of Alcohol as Influenced by Blood Sugar: DR. HOWARD W. HAGGARD and LEON A. GREENBERG. The Opercular Approach to the Pituitary: DR. A. A. ABRAMOWITZ. The Application of Sprays to Expanding Plant Surfaces: D. E. H. FREAR and PROFESSOR H. N. WORTHLEY. On the Structure of Pectin Polygalacturonic Acid: DR. P. A. LEVENE and LEONARD C. KREIDER	608
Science News	8

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COMMUNICATION ENGINEERING¹

By Dr. FRANK B. JEWETT

BELL TELEPHONE LABORATORIES

IN most respects the history of electrical communication and of the engineering on which it rests is typical of the history of all great modern industries based on science and which did not originate in the unrecorded and presumably accidental experiences of our remote primitive ancestors. The development of electrical communication in all its branches discloses the typical sequence of one or more phenomena disclosed by fundamental science research appealing to a man or men with some understanding of science and possessed of the inventor's imagination and urge to create new things of practical utility. Once the trail is blazed there follow in succession the eras of development, first by other inventors, then by engineers who know more of science than the inventors but who rarely create essentially new knowledge, and finally the era

in which development is mainly in the hands of research men and engineers working in intimate cooperation.

All branches of electrical communication—land line and submarine cable telegraphy, radio transmission, whether for telegraphy or telephony, and telephony by whatever means the signal impulses are transmitted or for whatever purposes employed—have gone through the several cycles. Further, they have spread out in this last era to embrace the art of permanent recording and subsequent reproduction of sound and much of the field of acoustics. In all these fields the major advances in the future over the present art are to be looked for in the research laboratory. Mainly I surmise these advances will emanate from the industrial research laboratory, although in the future, as in the past, revolutionary concepts are likely to originate in the laboratories of fundamental science and be brought to fruition in those of industry.

All forms of electrical communication are at base

¹ Address delivered at the symposium on recent progress of science in connection with the dedication exercises of the new building of Mellon Institute, Pittsburgh, May 7, 1937.

variant offshoots of common root stock. All require terminal apparatus to transform signal impulses into electrical impulses or the reverse; all require some form of conducting medium for these electrical impulses, either guided as in the case of wire transmission or broadcast as in radio, and all to a greater or less degree employ switching mechanisms, either manual or automatic.

Due to the nature of the impulses it must manipulate; to the necessity for simultaneous two-way transmission; to that of essentially instantaneous establishment on demand of connection in any random fashion between any two of an enormous number of terminal stations and because of the sheer magnitude in number of these connections made each day, the scientific and engineering problems of telephony are far greater and more complex than those of all other branches of electrical communication put together. Further, solution of problems in telephony rather automatically solve many problems in the less general cases which arise in the other branches.

Because of these facts and since the time available in this symposium is limited, I shall confine discussion to the field of two-way telephony as being typical and to a large extent though not wholly inclusive of the other fields of electrical communication.

About thirty years ago it became increasingly apparent that telephone development had outrun the possibility of large future advance wholly under the guidance of the inventor and engineer. The problems ahead, whether of terminal apparatus, transmission, switching or of economics, were such as to demand the attention of men thoroughly acquainted not only with current advances in the basic physical sciences but likewise with the powerful methods of investigation which were producing new knowledge. The urgency of many of the problems made it imperative both that all existing knowledge be scrutinized and employed when available and that new leads be developed more rapidly than was to be anticipated from the unorganized attack of individual investigators.

It was from the necessity of this situation that the beginning of industrial research as we now know it began in the field of electrical communication. Progress was slow at first, partly because it was a radically new approach little understood by those who had carried on successfully the previous development work and who were naturally skeptical; partly because it was difficult to know where and how best to start the attack, and largely because there were then very few suitable trained men available. Initially, judged by present-day criteria, much of the work, although scientific, was rather gross. Partly this was due to the nature of the existing structure on which we had to operate. Largely it was due to an almost complete

absence of proper tools and techniques with which to work. The present-day research man in a well-equipped communication laboratory can have little conception of the difficulties which confronted his predecessors in their attempts to solve high frequency problems without any high frequency generators, shielded bridges, unbalance sets, amplifiers or the hundred and one other laboratory tools which are now the commonplaces of everyday use. Actually for many years in the early days of research laboratory development a large part of the time and effort of the researcher was devoted to the creation of investigating and measuring tools.

Gradually, but with accelerated speed, the picture changed until now the research laboratory is fully recognized in the communication field to be the center from which come not only the advances in the art but also the basis for the engineering and operation of the new things it creates and the new methods it evolves. Subtract all or even a substantial part of the research laboratory and progress in communication would not only stop but the art would tend to retrograde and service to deteriorate. Present-day electrical communication is so completely a thing of intense applied science and is pressing so closely on each new discovery in fundamental science in certain fields that it can only exist serviceably in an expanding world through continued application of the methods which have brought it into existence.

Parallel with the growth of the research laboratory and with its increasing power to solve difficult problems, to expedite the utilization of each new piece of knowledge and to produce new things, methods and services has been an expansion of the fields of science into which its energies have been directed. Each advance has added to the possibility of still further advances and to the necessity for greater nicety in making those advances. Any major problem to-day is certain to require consideration of a wide variety of matters in the field of the physical and mathematical sciences and not infrequently of the biological as well. Hence we find a large amount of research work going on which at first sight seems to have little if any relation to electrical communication.

This tendency to expand the area of research interest and attack seems destined to continue. Already a very intricate and delicate structure, the telephone plant is becoming each day more intricate and delicate as it grows in size and diminishes in unit fundamental cost. Each day the premium on integrity of operation increases and the importance of having full knowledge of every factor which can affect that integrity is enhanced. The telephone plant is a vast completely integrated structure designed for but a single thing, namely, to provide a reliable service for the most

intangible thing in the world—the transmission of human thought. Being vast and completely integrated insignificant failures which elsewhere would at worst produce only moderate localized dislocation may here create disruption and disorder in distant places. A slowly acting but unsuspected chemical or physical reaction which in time will produce corrosion or disintegration of a vital contact or the failure of a crucial vacuum tube filament may throw into confusion a large part of the traffic over some important route or interrupt service across a continent or between continents.

It is because of this integration and complexity, combined with the magnitude of the multipliers involved, that research work in telephony is elaborate and conservative to an extent seldom if ever required elsewhere. Nothing of importance is ever standardized for general use in the telephone plant of the Bell System until it has undergone every laboratory test (including extensive service trial installations) which the ingenuity of trained scientists and engineers can devise. The penalties of failure are too great to do otherwise—we *must* know everything that present scientific knowledge enables us to know about each element of a new structure or system that is likely to affect operation during its service life.

There is no scintilla of doubt that our present electrical communication systems owe their existence to the research laboratory and to the engineering based on its work. Much of what they comprise could never have come into existence at all without the aid of highly organized industrial research laboratories. As for the rest, which was the art before they came into being, the costs incident to rising material and labor prices and to the inherent increase of cost with size in a telephone plant would have greatly limited growth. Thanks to the research laboratory we have thus far been able to offset these factors and it continues to be our hope for the future.

Now, in conclusion, a very brief survey of our present situation and of what the future seems to hold in store for communication research and engineering. The forward picture is quite different from what it was a few years ago when there were still geographical distances to be conquered or types of service which could not be given for lack of physical means.

The ultimate goal of telephone service is to give substantially instantaneous connection on every random demand, over a plant that is as nearly as possible 100 per cent. reliable and of essentially perfect transmission quality and at a cost which will insure maximum use—all within the limits of that financial safety without which no adequate service can be guaranteed or even provided. With no barrier of terrestrial distance now existing which can not in some fashion be

spanned by telephone channels if need arises, and with every major element which controls the giving of random two-way telephone service at least partially developed, the problems of research and engineering in the years ahead are essentially the problems of a better cultivation of the entire field, to the end that the ideal goal can be more nearly attained.

If essentially instantaneous compliance with the random demands of millions of subscribers for telephone connections is to be met it means that the telephone plant must be adequate to handle the offered service at times of peak desire. Since the need and desire to telephone is controlled by the normal necessities of life and the established business and social habits of people and not by those who provide the means for rendering service, and since experience has shown that the periods of peak demand occupy but a limited portion of each twenty-four hours, any approach to the ideal means inevitably a provision of plant so profuse that a very large part of it must be idle a majority of the time. Such a condition can only obtain within those limits of reasonable cost which will insure maximum availability to those who would employ the service if the inherent unit costs of the plant are low. In other words, the conditions require that many elements must be provided at a cost not greater than that which could be justified for a single element which would be capable of handling all the traffic if this traffic were substantially uniformly distributed throughout the entire twenty-four hours.

As a result of the work thus far done in the research laboratory substantial progress toward the attainment of the ideal has already been made. Further, if additional progress is to be made the research laboratory is practically the only place to which we can look for the facilities and methods which will be required. There is every present reason to believe that continuation of organized research work along the lines which have proven so fruitful in the past can be depended upon to carry us a long distance beyond where we now are. This continuation will require an increasing amount of attention to details whose influence and effect in a less developed state of the art are masked by grosser limitations.

Merely by way of illustration, since somewhat corresponding examples can be selected from almost any area, I would call your attention to what concentrated organized research has thus far done and is now doing in the direction of providing transmission channels in profusion.

Without going back to the time when open wires on poles with one pair of wires for each channel were substantially the only means available for connecting subscribers together, we are but little removed from the time when, whether as open wires or as pairs of

wires in cables, an actual physical circuit had to be provided for every connection that was made. The advent and development of loading coils and amplifying devices, both products of the laboratory, did not alter this necessity, although they did increase the distance over which communications could be given economically.

Until fundamental science, much of it involving new knowledge, was, through the coordinated work of industrial research, directed to the problem of extremely low-cost channel provision, there was essentially only one known way of providing a multitude of non-interfering channels along a common route. This was to assume that the electrical impulses over each channel were essentially alike and by means of geometrical and mechanical arrangement to reduce to a minimum the deleterious effects of transfer of energy from any circuit to its neighbors.

Recently, however, thanks to the research laboratory, operating in a myriad of fields and with organized utilization of the results in these fields, an entirely different method of providing large numbers of channels has been achieved and the way opened to an unknown indefinite extension. There is no time here to elaborate the niceties of the method. It is sufficient to say that it is what has commonly come to be designated as the carrier method, by which a single physical circuit can be made to transmit simultaneously a large number of non-interfering conversations by means of apparatus which is relatively simple and reliable and whose cost when apportioned among the several channels provides these channels much more economically than was possible under the older art. While there are definite limitations in the field of use of this method, it bids fair to have wide application over the longer distances. In its most advanced application, namely, that of the so-called coaxial cable, which is now undergoing trial in an experimental installation between New

York and Philadelphia, many hundred telephone conversations can be carried on over a single pair of physical channels.

Achievement of this and similar less spectacular results imposes a burden of extreme nicety and reliability on the functioning of many devices, since failure of any one will disrupt not a single conversation but a multitude of conversations. That such multiple transmission can even be contemplated seriously is high tribute to the power of scientific research which makes it possible.

Broadly speaking, the main emphasis of all research in the telephone field is directed toward the goal of producing terminal apparatus, switching mechanisms and channels of communication of great reliability and minimum cost, both first cost and cost of operation and maintenance—all to the end that facilities can be provided in the profusion needed for a uniform no-delay service at an expense to the subscriber which will have minimum tendency to restrict usage where telephony is the indicated preferred method of communication.

In two of the main sectors, namely, those of switching and trunk channels as between central offices or between cities, the purely technical problems of unit cost reduction are frequently made somewhat easier by the fact that certain of the elements lend themselves to wholesale treatment. In much of the third sector, however, namely, that of local distribution to the subscriber, the case is essentially one of dealing with a retail problem. Here, even if the equipment itself and the channel connecting it to the central office could be furnished at extremely low cost, there would still be a substantial item of investment involved in the fact that installation and maintenance cost would be relatively high. Even here, however, it is to the research laboratory that we must look for most of such help as it is to be anticipated.

EARLY WORK ON INSULIN¹

By F. G. BANTING, M.D.

UNIVERSITY OF TORONTO

I first wish to thank the Mellon Institute for their kind invitation to be present on this occasion. I wish also to congratulate you on this fine new research laboratory. It is a monument to the Mellon family and also a monument to the successful work of the institute in the past.

Although I have heard much of the Mellon Institute it was not until I read the book of your director that I understood the true significance and scope of your

endeavors. May I express the hope that your future activities will be crowned with equal or even greater achievement.

It was with great pleasure that I observed that the Mellon Institute is including in its activities certain problems in medical research. It is to be hoped that you will undertake research on other major problems in medicine and that you may even organize an attack on cancer.

The field of medical research is so wide that it is necessary to specialize. I did not therefore feel that I could adequately cover the field of internal secretions.

¹ Address delivered at the symposium on recent progress of science in connection with the dedication exercises of Mellon Institute, Pittsburgh, Pa., on May 7, 1937.

as requested in your invitation, but asked that I be allowed to speak on the internal secretion of the pancreas.

This task is more difficult than might be thought, because it is now fourteen years since I have done experiments on the internal secretion of the pancreas. I have, however, retained an active interest in the subject of diabetes. A very great deal of research had been done on the pancreas previous to 1920. It was known that there were two types of cells. One group, called acinous cells, produce powerful enzymes which are poured into the intestine for the digestion of food. These cells produce the external secretion. The other cells are fewer in number and occur in groups and are called the "Islands of Langerhans." These are the cells which produce the internal secretion.

It was known that the extirpation of the pancreas resulted in diabetes. It was also known that if the pancreatic duct was tied there was an atrophy of all the glandular cells which produce the external secretion, but the animal did not become diabetic. Many investigators had tried to make active extracts of the pancreas that would be of value in the treatment of diabetes.

The original hypothesis on which the work on insulin was based was that the enzymes of the cells of external secretion destroyed the active anti-diabetic product of the cells of internal secretion. Our whole effort was directed, therefore, to eliminating the destroying substances. We first ligated the pancreatic ducts in a number of dogs, waited some weeks for the acinous cells to degenerate, then removed and extracted the remaining cells. This extract was tested on a dog that had been rendered diabetic by removal of its pancreas. It was found that extracts made in this way contained an anti-diabetic substance, since they improved the clinical condition of the animal and decreased the amount of sugar in the blood and urine. Active extracts of the pancreas were also made by exhausting the glands of external secretion and thus getting rid of their destroying enzymes.

It was then found that an extract made from the pancreas of foetal calves of under 4 months' development contained a powerful anti-diabetic substance. Finally we found a chemical means of extracting the active anti-diabetic substance from the whole adult pancreas of the abattoir animals.

The production of a purified product then became the problem of the chemist. To Best, Collip, Shaffer, of St. Louis, and Clowes, of the Eli Lilly Company, must be given the credit for the early work on the purification. I would like to again pay tribute to the admirable cooperation of Dr. G. H. A. Clowes and his research group of the Eli Lilly Company in the early

struggle in extraction, purification and large-scale production of insulin.

From experiments on animals it was found that the physiological derangements caused by the removal of the pancreas could be corrected by the administration of insulin. It was proved that the increase of sugar in the blood could be lowered to normal or even subnormal levels; that sugar could be stored in the liver as in a normal animal; that whereas a diabetic dog can not burn sugar, it could be made to do so when insulin was administered; all the signs and symptoms of diabetes could be relieved; and the life of the depancreatized dog could be prolonged. Thus it was believed that insulin was the internal secretion of the pancreas and that its administration would relieve the symptoms of diabetes.

From this knowledge of the experimental work on animals we were able to predict the result of administering insulin to humans. One of the main factors in this prediction was that of diet. It must be remembered that when insulin was first used clinically diabetes was being treated by diet. Both patients and doctors had fixed ideas concerning what they should eat. Some were taught that diabetics should starve until they became sugar-free and then eat weighed amounts of fruits and vegetables which contained small amounts of sugar; some followed the high fat diet, while others used a combination of these two.

The pancreas of all diabetics, regardless of the severity of the disease, produces some insulin. Taking into consideration the variations in diet, the object of the treatment was to supply insulin in just sufficient amounts to compensate for the deficiency in the patient's pancreas.

From the physiological point of view there seemed no reason why a diabetic should not eat a normal diet. As early as August, 1922, one of our most severe diabetics was given a diet which included bread and potatoes and was kept sugar free by the use of insulin. When a group of diabetic specialists visited Toronto in November of that same year they would scarcely believe the records of this patient.

The time of administering insulin is an important factor. In order to have its action concurrent with the absorption of food it is advisable to give the injection 20-35 minutes before a meal.

If too much insulin was given we observed in the humans, as had been previously found with animals, that the blood sugar fell to subnormal level. This fall in blood sugar was accompanied by symptoms which we now call insulin shock. The administration of glucose caused a rapid return of the blood sugar level to normal and relieved the symptoms.

One of the most dreaded complications of diabetes

was coma. This condition was explained by saying that "fats only burn in the fire of carbohydrates." When the production of acetone bodies—aceto-acetic, beta hydroxy-butyric and acetone—become greater than the excretion these ketone bodies accumulate, producing drowsiness and coma. Previous to insulin coma was a common occurrence. Now I believe it is less common. Insulin was specific for coma, since it caused sugar to burn and with it the fats were completely oxidized.

Another complication of diabetes that was met with in the older patients was gangrene. In the pre-insulin days operation was dangerous and the patients usually died following the operation. Now diabetics can be safely operated upon because insulin controls the blood sugar and acetone production.

The early clinical results were obtained from an insulin which we now know contained impurities. Biochemists took up the problem of purifying the product. Abel, of Baltimore, in 1926, was the first to prepare insulin in crystalline form. The medium from which he obtained his crystals contained ammonium acetate, brucine and pyridine. The isolation of the crystals was attributed to the fact that the acidity could be adjusted to the isoelectric point of insulin, so slowly and so accurately that a supersaturated solution was obtained. Scott, of Toronto, working with Harington, of London, obtained crystals from amorphous insulin using a buffer solution of ammonium acetate and saponin. The yield of crystals produced by these methods was irregular.

On searching the literature Scott found that the pancreas contained considerable quantities of zinc (according to Lutz) and of cobalt and nickel (according to Bertrand). He then found that when traces of zinc were added to a buffered solution of amorphous insulin crystals were readily obtained. He explained the results of the saponin crystallization by the fact that the saponin contained zinc as an impurity. On examination it was found that Abel's crystals also contained zinc. Scott proceeded to test large numbers of metals and found that cadmium, nickel and cobalt could also be used in the crystallization, but were less satisfactory than zinc.

In the meantime, refinements were introduced into the methods of production of the insulin that was being used clinically. With the elimination of impurities the insulin was more rapidly absorbed and the duration of its effect was lessened. This made it necessary to increase the number of doses in order to maintain a patient free from sugar. Since insulin could only be taken by hypodermic injection the result was an added inconvenience to the patient.

Hagedorn, of Denmark, sought to prolong the effect

of insulin by adding protamine, which was obtained from sperms of rainbow trout and mackerel. Hagedorn and his colleagues, 1933-35, found that the addition of protamine to their insulin so delayed the action that the day's supply of insulin could be given in one injection. This was the greatest advance in the treatment of diabetes since the discovery of insulin. Scott found that when protamine was added to zinc-free amorphous insulin, there was little or no delay in the rate of absorption. If, however, zinc was added a combination occurred between the insulin and protamine with the characteristic slowing effect of the protamine. It would seem that the Danish insulin contained sufficient zinc or other specific metal to produce this combination.

Ordinary insulin, as used in Canada and the United States, is made by dissolving amorphous product which contains from 16 to 20 units per milligram. Protamine zinc insulin is made by adding definite amounts of zinc and protamine to ordinary insulin. By the addition of zinc to a solution of amorphous insulin 89 to 90 per cent. can be crystallized. Crystalline insulin has a potency of 23 units per milligram.

Another modification is being tested, namely, zinc alone to insulin. Scott had found in dogs that there was a prolonged blood sugar lowering effect following the injection of zinc insulin. This insulin is now being tested clinically by Dr. Hipwell, who has found that the effect of zinc insulin is intermediate between regular insulin and protamine insulin. It is too early to speak of the clinical value of this form of insulin.

The original hypothesis was that insulin could not be extracted from the pancreas because it was destroyed by the pancreatic juice. It is interesting to note that even the most purified insulin is digested by both trypsin and pepsin. Insulin is a protein from which nine amino acids have been isolated. In the digestion of insulin the total activity is lost when only 25 per cent. of the protein has been split.

Dudley, Rosenheim and Rosenheim found that the insulin prepared by the picric acid method contained spermine. This spermine was found to be a normal constituent of pancreas. Lutz found that the pancreas contained zinc. It may have been the presence of these substances in pancreas which resulted in the slow action of the early insulin preparation.

The chemistry of insulin has been extensively investigated; the clinical application has been widely accepted. It is estimated that over one million people receive insulin each day. Although much of the physiology is known, we do not yet know how insulin enables the body to utilize carbohydrates nor do we know the cause of diabetes.

OBITUARY

E. P. BURRELL

THE world of engineering and of science, particularly astronomy, has suffered a great loss in the untimely death of Mr. E. P. Burrell, director of engineering of the Warner and Swasey Company of Cleveland, makers of machine tools, but especially famous as builders of many of the world's great telescopes. Mr. Burrell was trained at Cornell in engineering, and while his work with the company was primarily as a designer and director of construction in its well-known line of turret lathes and other machine tools, it is chiefly in connection with his later work in the design and construction of modern reflecting telescopes that this note of appreciation of his many fine qualities of mind and heart attempts to deal.

Mr. Burrell's first essay in the design of large telescopes occurred in 1913 when the Warner and Swasey Company was awarded the contract by the Canadian Government for the mounting of a 72-inch reflecting telescope to be erected at Victoria, B. C. The details of the design were beautifully worked out by Mr. Burrell, who showed no less than genius in developing the mechanism required for the operation of the telescope in the most suitable and efficient, and at the same time, in the simplest possible form. It was the first telescope in which the polar and declination axes were wholly carried by self-aligning ball bearings and in which the motions were electrically operated and controlled. The completed telescope, in simplicity and beauty of design, in accuracy of construction and in speed and convenience of operation, as yet unsurpassed by any working telescope, and which has been in successful and fruitful use for nearly twenty years, forms a great tribute to Mr. Burrell's engineering ability and skill in design.

This was followed shortly afterward by the 69-inch Ohio Wesleyan telescope similar in form, but with improvements in detail. But the masterpiece of the Warner and Swasey Company and of its designer, Mr. Burrell, is undoubtedly the 82-inch reflecting telescope of the McDonald Observatory, Texas, now approaching completion. The specifications were exacting, requiring the utmost ingenuity and perseverance to fulfil. Some of the original features worked out by Mr. Burrell include a greatly shortened declination axis, permitting the Coudé beam to be reflected down the polar axis; duplicate elevating platforms, enabling the Cassegrain focus to be readily reached in any observing position, also serving for resilvering and changing accessories; a simple and convenient method for changing the secondary mirrors, and a special vacuum tube type

of electric drive. This mounting, now installed in its dome, sets a new standard in accuracy and convenience of operation.

No man can have a finer monument than these great telescopes for which Mr. Burrell was mainly responsible, nor can any man have a more enduring memorial than that provided by the work they are doing and will continue to do in adding to our knowledge of the universe. These speak in no uncertain tones of Mr. Burrell's outstanding scientific and engineering ability, but they fail to reflect another aspect of his character, his kindly and lovable personality. His many friends will sincerely mourn his passing and will cherish dearly the memory of his charity, patience and other lovable qualities of mind and heart, even more than his great intellectual attainments.

J. S. PLASKETT

DOMINION ASTROPHYSICAL OBSERVATORY,
OTTAWA, CANADA

RECENT DEATHS

DR. AMBROSE SWASEY, of the firm of Warner and Swasey, of Cleveland, manufacturers of telescopes and instruments of precision, died on June 15. He was ninety years old.

DR. W. T. MATHER, professor of physics at the University of Texas, died suddenly on June 14 at the age of seventy-two years. He had been a member of the faculty for forty years.

DR. HARRISON PRESCOTT EDDY, sanitary engineer of Boston, died suddenly on June 15 at the age of sixty-seven years.

DR. HANSFORD M. MACCURDY, professor of biology at Alma College, died on June 21. He was in his seventieth year.

JOHN M. CONDRIN, associate professor in the department of biology of the University of Toledo, died on June 9 at the age of thirty-two years. A correspondent writes: "He had been a member of the department since 1927. He was a graduate of Western Reserve University and received the M.A. degree from that institution in 1927 and was just completing work for his doctorate at the University of Michigan. He was a member of several national zoological societies and of both the Ohio and Michigan Academies of Science. He was the author of several publications on nudibranchs, genetics of pigments in mollusks and the physiology of hibernation in mammals."

SCIENTIFIC EVENTS

THE LINNEAN SOCIETY OF LONDON

ACCORDING to an account given in *Nature* of the anniversary meeting of the Linnean Society of London, which was held on May 24, the title of the presidential address of Dr. W. T. Calman was "James Eights, a Pioneer Antarctic Naturalist."

The Linnean Gold Medal was presented to Dr. F. F. Blackman, formerly reader in botany in the University of Cambridge. In making the presentation, the president said that the modern period of research on some of the fundamental problems of plant physiology began with the medallist's "Experimental Researches in Vegetable Assimilation and Respiration" in 1896. These "Researches," carried on with the aid of students, now number twenty-one, and recently a new series, "Analytical Studies in Plant Respiration," has been added. In 1905 Dr. Blackman published a paper entitled "Optima and Limiting Factors," which is a landmark in the study of the influence of external factors on physiological processes. The Trail Award of the society "to encourage study that throws light on the substance known as protoplasm, or the physical basis of life" was made to Dr. C. F. A. Pantin, Harding lecturer in zoology in the University of Cambridge, for his work on the mechanism of amoeboid movement showing that the protoplasmic changes involved are fundamentally similar to the processes which go on in cilia and in muscle.

The following were elected officers of the society for the year 1937-38: *President*, John Ramsbottom; *Treasurer*, Francis Druce; *Secretaries*, I. Henry Burkill and Martin A. C. Hinton; *New members of Council*, I. Henry Burkill, Miss M. L. Green, Dr. H. S. Holden, Fred Howarth and Professor F. E. Weiss. *Foreign members* elected were: Dr. Reinhard Dohrn, director of the Marine Biological Station, Naples; Dr. Herman Augustus Spoehr, director of sciences at the Division of Plant Biology of the Carnegie Institution, Stanford University; Professor Erick Anderson Stensiö, director of the Riksmuseets Paleontologiska Avdelning, Stockholm, distinguished for his researches on Old Red Sandstone fishes; Professor Nils Eberhard Svedelius, director of the University Institute at Uppsala and treasurer of the Swedish Linnean Society, known for his contributions to the knowledge of the taxonomy, morphology and life-histories of marine algae; Dr. Richard Woltereck, for many years professor of zoology in the University of Leipzig, and until recently director of the Zoological Institute, Ankara, Turkey. Professor Woltereck is known for his work in limnology. He organized and was the first director of the Freshwater Biological Station at Lunz in Austria and

has been editor of the *Internationale Revue der Gesamten Hydrobiologie und Hydrographie* since its commencement in 1908.

ST. LOUIS MEETING OF THE EASTERN SECTION OF THE SEISMOLOGICAL SOCIETY OF AMERICA

THE twelfth annual meeting of the eastern section of the Seismological Society of America was held at St. Louis University on June 11 and 12. Although this is the first time that the section has met so far west since plans for its organization were first made in St. Louis more than ten years ago, a representative group attended.

All sessions and the business meetings were held in the Commerce and Finance Building of the university. A brief address of welcome was given by the Rev. T. M. Knapp, S.J., chancellor of the university.

After attending to the usual business of the society, the reports of the chairmen of the various standing committees were given; of these, that by Rev. J. B. Macelwane, S.J., on amateur seismology was the most discussed. Plans were outlined to stimulate further the interest already manifest and to distribute information and a list of references on the construction and operation of amateur seismographs. Hope was also expressed that more space might be obtained in popular scientific magazines for publishing the activities and latest developments of amateur seismologists.

Colombia, South America; Ontario, Canada; the District of Columbia and the states of Texas, Alabama, Missouri, New York and Massachusetts were represented in the twenty papers that were presented following the business meeting.

On Saturday morning officers for the ensuing year were elected as follows:

Chairman, E. C. Jacobs, of the University of Vermont, Burlington, Vt.

Vice-chairman, H. E. McComb, of the U. S. Coast and Geodetic Survey.

Secretary, A. J. Westland, S.J., of the Department of Geophysics, Saint Louis University.

Treasurer, A. C. Chick, of Providence, R. I.

Fifth member of the Executive Committee, L. B. Slichter, Massachusetts Institute of Technology.

On Friday evening the members as a group attended a performance of "The Great Waltz" at the Municipal Open Air Theater. On Saturday, after a luncheon in the Pine Room of the Coronado Hotel as guests of the university, the group divided into two parties; the one visiting the Chester Illinois land slide, sixty-five miles southeast of St. Louis, and the other the Florissant

Seismological Observatory and the estate of Joseph Desloge on the Missouri River.

A. J. WESTLAND, S.J.,
Secretary

THE PROPOSED AMERICAN ASSOCIATION OF APPLIED PSYCHOLOGY

PROPOSALS for the organization of an American Association of Applied and Professional Psychology have been issued by a national committee, and a program of professional activities and applied research is planned for August 30 and 31 at the University of Minnesota in connection with the annual meeting of the American Psychological Association. All psychologists concerned with the application of psychology as a science, whether members or not of a national, regional, state or local association of applied psychology, are invited to participate in these meetings. The proposals for the American Association of Applied Psychology are published in full in the June issue of *The Journal of Applied Psychology*.

The need for a professional psychological organization had its inception in 1917 among psychologists in the United States Army during the World War and an association of clinical psychologists was then formed which in 1919 became the Clinical Section of the American Psychological Association. State associations of professional psychology commenced their development in 1921 with the New York State Association of Consulting Psychologists, out of which grew the present regional Association of Consulting Psychologists with a membership in twenty-one states and the District of Columbia. Now there are about fifteen state and regional associations, including associations well advanced in professional organization in New Jersey, Pennsylvania, Ohio, Minnesota, Illinois and Indiana. The proposals provide for an amalgamation of all professional psychological interests along similar lines to those followed by other professional national bodies.

The National Committee for Affiliation of Applied and Professional Psychology, which is composed of Robert G. Bernreuter (Penn. State), Francis N. Maxfield (Ohio State), Donald G. Paterson (Minnesota), Martin L. Reymert (Mooseheart) and Douglas Fryer (N. Y. U.), *chairman*, has had the assistance of a number of special committees in the preparation of its plans for the association. The program of the Minnesota meetings is prepared by a committee of affiliated organizations, of which Robert A. Brotemarkle, University of Pennsylvania, is chairman. Reports of applied research will be given on the mornings of August 30 and 31 and the afternoon programs consist of symposia for the discussion of professional problems such as the standardization of psychological measures, the

training and internship of applied psychologists, methods of conducting surveys of group attitudes and market research, the development of technical psychological manuals, the establishing of quantitative standards for the licensing of professional psychologists and planning for technical exhibits of psychological work.

The organization for an educational section has been prepared by a committee of fifty educational psychologists under the chairmanship of P. M. Symonds, Teachers College, Columbia University; for a clinical section it has been prepared by a committee under the chairmanship of F. N. Maxfield, the Ohio State University; for a consulting section by a committee under the chairmanship of Richard Paynter, Long Island University, and for an industrial and business section by a committee under the chairmanship of Harold E. Burt, the Ohio State University. Organization meetings for these sections will be held on August 30. Proposals for the organization of a board of affiliates, for the representation of state professional associations, have been prepared by J. Q. Holsopple, Trenton. The board of affiliates, which will integrate state professional activities on a national basis, will have its organization meeting on August 31. Members of the association may be accepted as members of specialized sections according to standards established by them, and these sections and the board of affiliates will have representation in the governing body of the association.

MARINE BIOLOGICAL LABORATORIES

THE Marine Biological Laboratory at Woods Hole, Mass., has opened its fiftieth summer season with the largest attendance in its history. The number of investigators and research assistants, when the registration for 1937 is complete, promises considerably to surpass the previous high figures of 362 in 1931 and 358 in 1936. The registration in the courses of instruction, which is limited by the available classroom space, as in past years, will be about 140. Of the five courses given in 1937, those in embryology, physiology and protozoology will be held during the first and those in invertebrate zoology and botany during the second half of the summer. As head of the course in invertebrate zoology, Professor T. H. Bissonnette, of Trinity College, this year succeeds Professor E. C. Cole, of Williams College, whose very successful services in this capacity began in 1932. Among the recent additions to the scientific equipment of the laboratory the most important is a new and very powerful x-ray unit, which will be under the general scientific supervision of Dr. G. Failla, of Memorial Hospital, New York City, and will be operated by an experienced technician. Another recently completed and useful aid to investigation is a large dehumidified room in which electrical measurements and experiments of various

sorts can be carried on satisfactorily during the dampest weather encountered at the seashore. Among other special equipment housed in this room will be hydrogen and glass electrodes for hydrogen-ion determinations; these instruments, like the x-ray plant, will be under the supervision of a trained operator whose services will be available at all times to those who need them. As in past years a glass-blower, a photographer, a scientific artist and several mechanics will assist in caring for the more highly technical needs of investigators.

During the present summer the Scripps Institution expects a number of visiting investigators who will work together with the members of the staff or be engaged in special research, mainly on biological problems and on marine sediments. In the summer session of the University of California a lecture course, Introduction to Oceanography, will be offered. At the end of June members of the staff will take part in a third cruise on the *Bluefin*, the boat of the California Fish and Game Commission, in order to continue, in co-operation with the Fish and Game Commission, the studies of the currents in the general area between Point Conception and San Diego. Two cruises, during each of which about thirty stations were occupied, have already been completed. No field work at sea can be undertaken by the institution alone, since the boat *Scripps* was lost in November last and since the new 104-foot auxiliary schooner that R. P. Scripps has bought for the institution will not be ready for work before the end of the summer. The new boat is being remodeled, a small deck-house laboratory is to be built, laboratories below deck to be equipped, and winches and other gear to be placed on deck. It is hoped that the boat will be transformed into an excellent ship for oceanographic work and that a systematic study of the waters off the coast soon can be commenced.

The Mt. Desert Island Biological Laboratory at Salisbury Cove, Maine, is open as usual this year from June 15 to September 15. Dr. Earl O. Butcher, of Hamilton College, is acting director in the absence of Dr. William H. Cole. No courses of instruction are offered, but facilities for research in biology are available for independent investigators. Sixteen workers have arranged to work at the laboratory this summer, studying such subjects as pharmacological effects on the blood pressure of elasmobranchs, maturation in various molluscan eggs, color changes in invertebrates, kidney function in fishes, digestion in medusae and gametogenesis in gastropoda. It is also planned to continue the project of taking motion pictures of typical marine invertebrates for instructional use.

AWARDS OF LATIN AMERICAN FELLOWSHIPS BY THE GUGGENHEIM FOUNDATION

TEN scholars from Latin America will work in the United States during the year 1937-38 on fellowships granted by the John Simon Guggenheim Memorial Foundation. The foundation was established in 1925 by former United States Senator Simon Guggenheim and Mrs. Guggenheim, in memory of a son, and its endowment fund is wholly their gift. The Latin American fellowships are at present available to citizens of Argentina, Chile, Cuba and Mexico, as well as to Puerto Ricans. The grants are made, on terms similar to those governing the Guggenheim fellowships awarded annually to citizens of the United States, to scholars and artists of proved ability in their field of work. The selection of the fellows whose names are now announced was made by a committee of scholars which met in New York, with the advice and assistance of scholars of the countries in which applications originated. About two hundred applications for Latin American fellowships were received this year.

The awards are as follows:

CONRADO FEDERICO ASENJO, instructor in chemistry, School of Tropical Medicine, San Juan, Puerto Rico: Chemical studies of medicinal and poisonous plants of the West Indies.

DR. ALFREDO BAÑOS, JR., professor of theoretical physics in the faculty of physical and mathematical sciences of the National University of Mexico: Continuation of studies in the field of theoretical physics, with emphasis on the theory of cosmic radiation, at the Massachusetts Institute of Technology. (Renewal.)

DR. CARLOS GARCÍA ROBIOU, assistant professor in anthropology, University of Habana: Archeological and ethnological studies of aboriginal remains of Cuba which are to be found in certain museums of the United States.

CARLOS GRAEF, professor of mathematics in the National School of Physical and Mathematical Sciences, Mexico: Studies of the theory of probability and the mathematical theory of statistics, at the Massachusetts Institute of Technology.

ANDRÉS HENESTROSA, librarian of the Department of Foreign Relations, Mexico: Continuation of studies of the significance of Zapotecan culture, chiefly in the Department of Middle American Research, Tulane University, New Orleans. Mr. Henestrosa is himself a Zapotecan Indian, born in the state of Oaxaca, Mexico. He spoke only the Zapotecan language until he was fourteen years old. (Renewal.)

DR. JOAQUÍN LUÇO, chief of practical work and associate professor in the department of physiology, Catholic University of Chile: Experimental studies in physiology, in particular the action of certain drugs on smooth muscle. Dr. Luço will work at the Harvard Medical School with Dr. Arturo Rosenblueth, a former Guggenheim fellow from Mexico who is now an assistant professor of physiology at Harvard.

DR. ALBERTO MARSAL, acting professor of biochemistry, Medical School of the National University of Cordoba, Argentina: Studies in the biochemistry of the thyroid gland, chiefly at the Harvard University Medical School.

DR. ENRIQUE SAVINO, bacteriologist of the Institute of Bacteriology of the National Department of Hygiene, Buenos Aires, Argentina: Continuation of studies in the field of public health, with emphasis on epidemiology, at Harvard University. (Renewal.)

PROFESSOR SANTOS SORIANO, acting professor of microbiology, University of Buenos Aires, Argentina: Studies of the artificial production of bacterial variations, in certain research institutions in the United States. Professor Soriano has published the results of many studies in the field of microbiology, some in collaboration with his wife, who is a doctor of natural history.

DR. SILVIO ARTURO ZAVALA, research assistant at the National University, Mexico: A comparative study of the

systems of forced labor in the Spanish and English colonies of North America, in consultation with scholars in the United States.

The trustees of the foundation are Senator and Mrs. Guggenheim, Francis H. Brownell, Carroll A. Wilson, Charles D. Hilles, Roger W. Straus and Charles Earl.

The Committee of Selection consisted of President Frank Aydelotte, Swarthmore College, *chairman*; Dr. Thomas Barbour, professor of zoology and director of the Museum of Comparative Zoology, Harvard University; Dr. Elmer Drew Merrill, administrator of the Botanical Collections of Harvard University; Dr. Antonio G. Solalinde, professor of Spanish at the University of Wisconsin; Dr. Hans Zinsser, professor of bacteriology and immunology at the Harvard Medical School.

SCIENTIFIC NOTES AND NEWS

At the commencement of Yale University on June 23 the doctorate of science was conferred on Dr. John Howard Northrop, Princeton, N. J., member of the Rockefeller Institute for Medical Research, and on Dr. Ernest Orlando Lawrence, professor of physics at the University of California.

RUTGERS UNIVERSITY conferred on June 13 the degree of doctor of laws on Dr. James Rowland Angell, retiring president of Yale University, and the degree of doctor of science on Dr. Edward R. Weidlein, director and vice-president of the Mellon Institute, Pittsburgh.

THE degree of doctor of science was conferred at the commencement of Tufts College on June 14 on Dr. Leonard Carmichael, professor of psychology and dean of the Faculty of Arts and Sciences of the University of Rochester.

DARTMOUTH COLLEGE at commencement conferred the degree of doctor of laws on Rear Admiral Richard E. Byrd and the degree of doctor of science on Dr. Edward R. Baldwin, director of the Edward L. Trudeau Foundation at Saranac Lake, and on Dr. Walter Walters, surgeon of the Mayo Clinic.

THE degree of doctor of science was conferred by Coe College on June 7 on Dr. Horace W. Stunkard, professor of biology, New York University. Dr. Stunkard received the degree of bachelor of science from Coe College twenty-five years ago.

At its commencement exercises on June 14, the University of Colorado conferred the degree of doctor of science on Dr. Sara E. Branham, senior bacteriologist of the U. S. Public Health Service at Washington, in recognition of her contributions to bacteriology in relation to public health.

DR. IRVIN ABELL, since 1904 professor of surgery at the University of Louisville, Kentucky, was made president-elect at the eighty-eighth annual meeting of the American Medical Association, held in Atlantic City from June 7 to 11.

DR. HENRY A. CHRISTIAN, Hersey professor of the theory and practice of physic at the Harvard Medical School, has been elected a corresponding member of the Medico-Chirurgical Society of Edinburgh.

At the annual convention of the American Laryngological Association at Atlantic City, the De Roaldes Medal for research on nose and throat ailments was awarded to Dr. Lee Wallace Dean, head of the nose and throat department of the Washington University School of Medicine, St. Louis.

W. H. SWANGER, chief of the section of mechanical metallurgy and assistant chief of the division of metallurgy of the National Bureau of Standards, and G. F. Wohlgemuth, associate metallurgist, have been awarded the Charles B. Dudley Medal for 1937 for their paper entitled "Failure of Heat-Treated Steel Wire in Cables of the Mt. Hope, R. I., Suspension Bridge," which describes the extensive work undertaken by the National Bureau of Standards to determine the causes of the failure. This medal, which commemorates the name of the first president of the American Society for Testing Materials, is awarded to "the author or authors of a paper presented at the preceding annual meeting which is of outstanding merit and which constitutes an original contribution on research in engineering materials." The medal will be presented to Messrs. Swanger and Wohlgemuth on June 30 during the fortieth annual meeting of the society in New York City.

THE Emil Chr. Hansen Gold Medal and a prize of 3,000 Danish crowns has been awarded to Dr. Aurelio Quintanilha, professor of botany at the University of Coimbra, for his investigations on sex in the Hymenomyces.

THE Adlerschild of the German Empire has been awarded to Dr. Vladimir Köppen, professor of meteorology at the University at Graz.

THE Albert I of Monaco Prize of 100,000 francs has been given by the French Academy of Medicine to Dr. Paul Bouin and Dr. Ancel for their work on the sex hormones and the interstitial glands in man.

DR. PHILIP A. SHAFFER, professor of biological chemistry and head of the department in the Washington University School of Medicine, St. Louis, has been appointed dean. He succeeds the late Dr. W. McKim Marriott, who shortly before his death had resigned to become dean of the Medical School of the University of California.

DR. EDWARD J. VAN LIERE, acting dean of the School of Medicine of West Virginia University, has been made dean. He has been professor of physiology at the university since 1922.

DR. HENRY B. HASS, director of research of the department of chemistry of Purdue University for the past year and a member of the staff since 1928, has been made head of the department. He will take over the work that has been conducted by an administrative committee of which he was a member.

DR. ABEL WOLMAN, chief engineer of the Maryland State Department of Health, has been appointed professor of sanitary engineering at the Johns Hopkins University. John C. Geyer, assistant professor of hydraulic and sanitary engineering at the University of North Carolina, has been appointed associate.

DR. J. H. RUSHTON, assistant professor of chemical engineering at the University of Michigan, has been appointed professor of chemical engineering at the University of Virginia.

DR. GEORGE W. KIDDER, of the department of biology at the College of the City of New York, has been appointed assistant professor of biology at Brown University.

DR. THOMAS PARK, associate in the department of biology of the School of Hygiene and Public Health of the Johns Hopkins University, has been appointed instructor in zoology at the University of Chicago.

DR. WALTER C. LOWDERMILK has been appointed chief of the Soil Conservation Service. He will assume full responsibility for the development and prosecution of a broadened research program adequate

to meet the pressing need for additional basic information in the relatively new field of soil erosion control. He will continue for the present to serve as associate chief of the service. Dr. Lowdermilk was formerly project leader in charge of studies in erosion and stream flow at the California Forest Service Experiment Station. In 1933 he was named vice-director of the Soil Erosion Service of the Department of the Interior. When this agency was transferred to the Department of Agriculture as the Soil Conservation Service, he became associate chief.

DR. OSKAR BAUDISCH has been appointed director of research at the New York State Research Institute for Hydrotherapy at Saratoga Spa. The new research institute is a memorial to the late Professor Simon Baruch, of Columbia University.

DR. RICHARD PEARSON STRONG, professor of tropical medicine at the Harvard Medical School, who has spent five months in Peru in connection with his study of parasitic pernicious anemia, returned to New York on June 15. He was accompanied by Mrs. Strong and by members of the expedition: Dr. Emory Pinkerton, pathologist; Dr. David Weinman, research fellow; Dr. Marshall Hertig, entomologist, and M. L. Bennett, technician.

DR. MAX MASON, member of the executive council of the California Institute of Technology, formerly president of the University of Chicago and of the Rockefeller Foundation, was the commencement speaker at the institute on June 11.

DR. WALTER TIMME, professor of neurology at the College of Physicians and Surgeons of Columbia University, addressed the graduates at the ninety-first commencement exercises of the College of the City of New York.

DR. WARFIELD T. LONGCOPE, professor of medicine at the Johns Hopkins University and physician-in-chief of the Johns Hopkins Hospital, gave the address to graduates of the Albany Medical College on June 14.

THE seventh John Mallet Purser Lecture was recently delivered by Professor E. D. Adrian at Trinity College, Dublin. His subject was "The Physiology of Sleep."

THE new exhibit hall of the Mount Wilson Observatory and an auditorium seating 275 people was dedicated on June 14. Dr. John C. Merriam, president of the Carnegie Institution of Washington, D. C., made the principal address.

THE Case Chapter of the Society of the Sigma Xi held its annual initiation on the evening of June 4. Four faculty members and sixteen students were elected to full membership. Officers elected for the

next year were Professor G. L. Tuve, *president*; Professor G. E. Barnes, *vice-president*; Professor T. M. Focke, *treasurer*, and Professor Richard S. Burington, *secretary*. Following the ceremonies, at which Professor J. R. Martin, retiring president, presided, Professor Philip Morse, of the Massachusetts Institute of Technology, spoke on "Physics in Industry."

THE Executive Committee of the International Council of Scientific Unions will meet at Paris, to meet the Committee of Scientific Experts, on July 9 and 10, by invitation of the Organisation Internationale de Coopération Intellectuelle of the Society of Nations.

A SUMMER evening course on modern aspects of organic chemistry is being given at the University of Chicago on Monday evenings from 7 to 9 P. M., beginning on June 21. The program for this course is as follows: "The Application of the Theory of Absolute Reaction Rates to Some Typical Organic Reactions," Professor Henry Eyring, Princeton University; "Unit Processes in Organic Synthesis," Dr. P. H. Groggins, Bureau of Chemistry and Soils; "The Mechanism of Organic Reactions in Gaseous State," Dr. Louis S. Kassel, Universal Oil Products Company; "Some Problems in the Field of Carbohydrate Chemistry," Professor William Lloyd Evans, the Ohio State University; "Infra Red Absorption Spectra of Organic Compounds," Dr. Oliver R. Wulf, Bureau of Chemistry and Soils; "A Survey of the Sulfur Compounds," Professor E. Emmet Reid, the Johns Hopkins University; "Chemistry and Physiological Function of Vitamin B₁," R. R. Williams, the Bell Telephone Company; "Recent Advances in Rubber Chemistry," "Organic Fluorides," Thomas Midgley, Jr., Ethyl Gasoline Corporation; "The Theoretical Principles of Catalytic Reactions," Dr. V. N. Ipatieff, Universal Oil Products Company, and "Heavy Hydrogen in Organic Chemistry," Dr. Weldon G. Brown, University of Chicago.

THE annual spring meeting of the Indiana Academy of Science was held under the presidency of Dr. Will E. Edington, at Winona Lake, Ind., on May 21 and 22. On the evening of May 21 a brief business session was held; and talks were given on lake borings by Dr. Ira T. Wilson, and on the work of the Indiana University Biological Station on the lakes of Northern Indiana and lake problems by Dr. Will Scott. On May 22 there was an early morning bird tour of the region, and a demonstration of lake-boring apparatus and types of work done at the Biological Station. In the afternoon there was a visit to the near-by state fish hatcheries; and the botanists devoted themselves to an exploration of the spring flora of the vicinity. Over one hundred members were in attendance.

LECTURES and demonstrations of the most modern treatments of all types of eye diseases and disorders given by sixteen leading ophthalmologists during a six-day post-graduate course in ophthalmology were conducted by the School of Medicine of the George Washington University during the week from May 31 to June 5. Those who took the course spent an afternoon at Walter Reed Hospital, where they heard lectures and attended demonstrations by Major Frederic Thorne, Captain R. F. Brandish, Lieutenant-Colonel James E. Ash and Captain Elbert DeCoursey, all of the United States Army Medical Corps. Another afternoon session was held at the National Bureau of Standards, where the group were conducted on a tour of the laboratories of the optics division. Members of the staff devoted the afternoon to the discussion of problems in the field of physics and optics and of allied subjects of practical value to clinical ophthalmologists. Those who spoke were Dr. K. S. Gibson, Dr. D. B. Judd, Dr. W. F. Meggers, Dr. I. C. Gardner, Dr. M. G. Lloyd, F. J. Bates and A. N. Finn.

A COURSE in dental science will be given under the auspices of the department of anthropology at Columbia University during the next academic year. It will be directed by Dr. M. Russell Stein, instructor in dental anatomy at the Columbia School of Medicine, and will include the anatomy of human dentition, evolution and comparative anatomy, evolutionary theories, dental fossils of apes and primitive man, primitive dental customs, folk lore of the teeth, comparative and human dental pathology and early and modern dental therapy. Students will be instructed by visual methods. The lectures will be illustrated by dental specimens carved in soap, as well as with lantern slides, blackboard drawings and charts. Examinations will consist of identifying animal and human teeth from small collections as they might be gathered in archeological research.

APPLICATIONS, accompanied by recommendations from directors of museums, for the position of interne, are invited by the Buffalo Museum of Science, where six vacancies in biology, anthropology and the physical sciences are to be filled. These positions have been provided for by a grant of \$50,000 from the Rockefeller Foundation.

THE Council of the British Association has resolved, according to *Nature*, that the association should become a constituent member of the Parliamentary Science Committee, and appointed as its representative Professor Allan Ferguson, one of the general secretaries of the association. The arrangement made is subject to revision after three years. *Nature* points out that the announcement will afford particular pleasure to the members of the British Science Guild,

which has now been incorporated with the British Association. The Guild and the Association of Scientific Workers were the parent bodies of the Parliamentary Science Committee, which came into being in October, 1933, almost immediately after the presidential address of Sir Frederick Gowland Hopkins at the Leicester meeting of the British Association.

FIGURES have recently been issued by the Soviet Union Year Book Press Service, according to *Nature*, relating to the increase in the number of Soviet professional workers in the Ukraine. In 1914, the terri-

tory now constituting Soviet Ukraine had 44,000 teachers; at the beginning of the school year 1936-37 the number had risen to 150,000. The number of medical men in 1913 was 5,192; in 1936 it was 19,200. The number of secondary medical staff in 1913 was 8,357 and in 1936 40,243. In 1934 there were 83,300 engineers and technical experts employed in the Ukraine; in 1936 the number had increased to 116,600. The number of agronomists employed by the Commissariat of Agriculture in the Ukraine three years ago was 8,200; in January, 1936, it was 12,346.

DISCUSSION

COBALT—AN ESSENTIAL ELEMENT IN ANIMAL NUTRITION—AUSTRALIAN INVESTIGATIONS

In 1933 Filmer,¹ working with Underwood in Western Australia on a disease of cattle and sheep (characterized by progressive emaciation and anemia followed by death), to which he gave the name "enzootic marasmus," pointed out the similarity between this disease and "bush-sickness" in New Zealand, "nakurutitis" in Kenya, "pine" in Scotland, and "salt-sick" in Florida. The iron deficiency theory which had been advanced to explain the etiology of these diseases was criticized and the hypothesis advanced that enzootic marasmus was due to a deficiency in the herbage of some trace element which was present as a contaminant of the iron compounds which cured and prevented the disease. This hypothesis was based in the main on the following experimental findings.

(1) Extremely high doses of iron compounds were required for curative results, with very little correlation between the size of these doses and the amount of iron which they supplied.

(2) Fresh and heat dried whole liver was curative in doses which supplied insignificant amounts of iron.

(3) The iron content of "unsound" (i.e., disease-producing) pastures was very little lower than that of normal pastures.

(4) The livers and spleens of affected animals contained excessive stores of iron—the reverse of the condition expected in iron-starved animals.^{1, 2}

These workers then produced an iron-free extract of one of the curative iron compounds (limonite $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$) and found it to be fully as potent in the cure of enzootic marasmus as whole limonite.³ This effectively settled the iron deficiency theory and gave strong support to the trace element hypothesis. Twelve months later it was shown by a fractionation

method⁴ that the potency of this extract, and therefore of whole limonite, was due to the cobalt which it contained. Normal growth and health of sheep in the affected area was obtained with doses of cobalt chloride supplying as little as 0.1 mg cobalt and of cattle with 0.3 to 1.0 mg cobalt daily, and it was suggested that cobalt must be considered an essential element in animal nutrition.

At this time Marston and Lines were working on a rather similar problem in South Australia known as "coast disease" of sheep. They could neither cure nor prevent the disease with the particular iron compounds used in the doses supplied and tried the effect of adding a number of trace elements, including cobalt, to the sheep's diet. The cobalt was suggested by its known effect in producing polycythemia in rats. Success with doses of cobaltous nitrate supplying 1 mg cobalt daily per sheep was reported by Marston and Lines⁵ and to these workers must be given the credit of having first successfully used cobalt in the treatment of a disease of animals.

During this time the iron deficiency theory was not proving an entirely satisfactory explanation of the etiology of "bush-sickness" in New Zealand. Riggs and Askew found only very small differences in the iron contents of "sound" and "unsound" herbage in the south island and suggested soil contamination with iron as a factor in the incidence of the disease. Later they found that the curative effect of certain soil and limonite drenches did not depend solely on their iron contents. In the north island Grimmer and Shoreland⁶ found the iron contents of various iron ores inadequate to account for their differences in curative value. The experiments of Filmer and Underwood with "iron-free" extracts were then repeated with "bush-sick" animals. Successful results with such extracts were obtained both in the north and south islands.⁷ Significant amounts of cobalt were noted in

¹ *Aust. Vet. Jour.*, ix: 163.

² Underwood, *Aust. Vet. Jour.*, x: 87, 1934.

³ Filmer and Underwood, *Aust. Vet. Jour.*, x: 84, 1934.

⁴ Underwood and Filmer, *Aust. Vet. Jour.*, xi: 84, 1935.

⁵ *Jour. Council Sci. and Indust. Res. Aust.*, 8: 111, 1934.

⁶ *Trans. Roy. Soc. N. Z.*, 64: 191, 1934.

these extracts and experiments initiated to test its potency just as the report of the findings of Underwood and Filmer with this element were received. Successful treatment of bush sickness with small amounts of cobalt were reported by Askew and Dixon as mentioned above and later by Wall.⁸ Since that time a considerable volume of work on the relation of cobalt to the incidence and control of bush sickness has been carried out by the New Zealand workers, not the least important of which is the development of a chemical method capable of determining as little as 0.2 gamma cobalt.⁹

E. J. UNDERWOOD

DEPARTMENT OF AGRICULTURAL
CHEMISTRY,
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A POSSIBLE SOURCE OF LABORATORY FIRES¹

THE conditions necessary for the observation of the phenomenon described herein are common to most laboratories, and the possibilities they have for causing laboratory fires may be already generally known. However, since there is apparently no record in the literature it seems advisable to describe an experience that might well have resulted more disastrously than it did.

On opening the laboratory after a week-end the room was found to contain smoke and there was an odor of burnt wood. The source of the smoke and odor was found to be a smouldering area on a laboratory table top near a two-liter florence flask filled with benzene. The flask and its contents were quite warm, but fortunately the flask was not stoppered, being, instead, covered with an inverted beaker. The burned place in the table was curved in shape and a defect of about one half inch had been made. It was found that what had happened was that the round flask filled with perfectly clear fluid had acted as an efficient sun glass and brought the sun rays to a focus on the table. The laboratory had been closed for a period of one and a half days, during which time the sun shone brightly. The laboratory table was on the south side of the room near a large window, and sunlight was able to enter for a considerable portion of the day. The table top was black, and it was easy to demonstrate that in a few moments the flask placed in bright sunshine caused the wood to smoke. A hole was burned in a piece of black paper almost

immediately. Inflammable liquids (ether, benzene, carbon disulfide) poured on the table evaporated before they could be ignited.

It is quite certain that had the flask been tightly stoppered the increased temperature would have burst the flask and brought the highly inflammable benzene in contact with the glowing embers to cause a fire. Also had the table top been of softer wood, as for example pine, the focused sun rays may have induced a flame.

It seems a worthwhile precaution to avoid storing clear fluids in globular glass vessels where they are exposed to direct sun rays, unless they are placed on a white table covering. It may be that the nature of the fluid in the flask, its color and the amount in proportion to the capacity of the flask influence the possibility of the sun glass effect.

JULIAN H. LEWIS

"HYPOTHECATE" VERSUS "ASSUME"

IN a recent proof of the Proceedings of the American Physiological Society appears the phrase: "Each hypothecated element in the nerve." This misuse of the word hypothecate in scientific literature is not infrequent. The dictionary defines "hypothecate" as "give or pledge as security; pawn or mortgage." I am myself to blame for the introduction of finance into physiology through the term "oxygen debt." I should be sorry, however, to have it go too far, or to see my friends, on both sides of the Atlantic, reduced to pawning the elements either of their nerves, or of their hypotheses. Let them "assume" these elements, not "hypothecate" them.

A. V. HILL

UNIVERSITY COLLEGE, LONDON

WILLIAM MORTON WHEELER AND THE CLASSICS

No friend of William Morton Wheeler can read unmoved the beautiful appreciation of him in *SCIENCE*. May I add a word on a point barely noticed?

The reader of Wheeler's great monograph on the ant will not fail to see how intimate he was with Vergil's "Georgics." But very few of his friends and pupils are aware that a commanding knowledge of the Greek and Latin classics made part of the superb intellectual equipment of this self-taught man. He read them as we read French or German. One day last summer he said to me: "I have just read Aeschylus, Sophocles and Thucydides, and Tacitus." Of course it was Greek that he cared for most. When a boy he picked up a speaking knowledge of the modern lingo from Greek fruit sellers in the streets of Milwaukee. From that he worked backward, and it was not long before he was carrying a Greek classic in his pocket.

HENRY OSBORN TAYLOR

¹ *N. Z. Jour. Agr.*, 50: 267, 1935; Askew and Dixon, *N. Z. Jour. Sc. and Tech.*, 18: 73, 1936.

⁸ *N. Z. Jour. Sc. and Tech.*, 18: 642, 1937.

⁹ Kidson, Askew and Dixon, *N. Z. Jour. Sc. and Tech.*, 18: 601, 1936.

¹ From the Otho S. A. Sprague Memorial Institute and the Department of Pathology, University of Chicago.

SCIENTIFIC BOOKS

MODERN PHYSICS

Die Bedeutung der Modernen Physik für die Theorie der Erkenntnis. Drei mit dem Richard Avenarius-Preis ausgezeichnete Arbeiten von Dr. Grete Hermann, Dr. E. May, Dr. Th. Vogel. viii + 210 pages. S. Hirzel, Leipzig. 1937.

The Philosophy of Relativity. By A. P. USHENKO. 208 pages. George Allen and Unwin, Ltd., London, 1937. \$3.00.

THESE two works illustrate the lively interest which philosophers are exhibiting in the philosophical implications of the quantum theory and theory of relativity. The German work consists of three excellent essays which received prizes in a recent competition conducted by the Academy of Sciences of Saxony. The tenor of the first two essays is conservative; both authors argue that fundamental presuppositions, such as the principle of causality and the concept of substance, which have been inherited from historical theories of knowledge, are basic for the new physical theories. Dr. Hermann distinguishes between causality and predictability, and thereby preserves the principle of causality for quantum mechanics. Her thesis is valuable in that it calls attention to the fact that measurement, in quantum theory as well as classical physics, involves a coupling between the value of a physical quantity of an object and the value of some indicating quantity of a measuring instrument. Dr. Hermann also presents an illuminating analysis of the Lorentz transformation. The conclusion of her monograph is that space and time and causality are preserved in the newer theories; it is their relativistic application which is new in the theories of relativity and quantum mechanics.

Dr. Hermann's essay is essentially an analysis of fundamental concepts and principles of physics. In the longer work of Dr. May the more detailed epistemological presuppositions are studied. He argues correctly that the fundamental concepts of the theory of knowledge are presupposed by the new as well as by classical physics. Of especial importance is his demonstration that the quantum mechanical disturbance of the object in observation is reducible to the empirical fact that a measuring instrument interacts with the object, and has nothing whatsoever to do with the philosophical problem of the perception of an external world. Dr. May adopts Dr. Hermann's distinction between causality and predictability and thus obtains a basis for the assertion that the realm of physical processes is strictly determined, even though exact prediction is not possible. The reviewer disagrees with this dualism between physical reality and its theoretical representation, and also with the thesis that

space is known to intuition as necessarily Euclidean and time as absolute. But a discussion of these philosophical matters, to which the physical theories are indifferent, is hardly a suitable topic for a limited review.

The third essay by Dr. Vogel reveals an influence of logical positivism which restricts philosophy to a clarification of the meaning of language and of the calculus which constitutes mathematical physics. Dr. Vogel, however, retains his sense of reality and insists that natural science is more than a language. He emphasizes the function of principles of correlation between symbols and experience. This paper contains an excellent analysis of causality.

In contrast to the philosophical conservatism of Hermann and May and the positivism of Vogel, Professor Ushenko argues that new metaphysical doctrines are implied by the theory of relativity. He states that classical physics was based upon the concept of substance, whereas in the theory of relativity the concept of event is basic. He develops a metaphysics of events with much brilliant analysis. Events, which are agents of the physical world, are described by dispositional characteristics, i.e., by characteristics which are not manifested unless an observer is present; but an event must have an essence which is distinct from its dispositional properties, in order to exist in its own right. This essence is a fusion of space and time. Space-time is a structure of events which transcends experience, but is the condition of correlations of acts of experience.

The reviewer believes that both classical and relativistic physics may be interpreted in terms of a metaphysics of substance or events. Indeed, we have seen that Dr. May asserts the necessity of the concept of substance in the new physics. Professor Ushenko asserts that size, shape and mass are the three properties which condition the sameness of substance, and since these properties are relative they can not determine unambiguously the identity of a physical substance. But the electric charge of a body and space-time interval are invariants which may provide for the self-identity of substance. Furthermore, it might be argued that constancy, and not invariance, should be adopted as the criterion of substance. While electricity may be interpreted in relativistic theory as substance, a substantial entity of classical physics may be interpreted as a series of events. Indeed, Mach interpreted the things of classical physics as complexes of elements of sensation. The reviewer believes in opposition to the theory of the present book that the essence of an event may be expressed as the law of correlation of its perspectives.

The book is intended for philosophers. In order to assist their understanding of relativity the author presents simplified mathematical expositions of the special and general theories. The analysis of physical

concepts, however, is not as penetrating as that of Dr. Hermann's essay.

V. F. LENZEN

UNIVERSITY OF CALIFORNIA, BERKELEY

SOCIETIES AND MEETINGS

THE NORTH CAROLINA ACADEMY OF SCIENCE

THE thirty-sixth annual meeting of the North Carolina Academy of Science was held at Catawba College, Salisbury, N. C., on May 7 and 8. This was the first time that this institution has been host to the academy. About two hundred and fifty members and visitors attended the meeting. Forty-four papers and four exhibits made up the program. The proceedings will be published in the *Journal of the Elisha Mitchell Scientific Society*.

The General Section met on the first day with P. M. Ginnings, president of the academy, presiding. The reading of papers, mostly of general interest, commenced at 9:30 A.M. and continued until 4.30 P.M., when the annual business meeting was held. The principal matters taken up were the reports of the various committees and the election of officers.

Resolutions were read honoring the late Dr. David H. Howard, Jr., department of chemistry, Davidson College. The academy elected to life membership Professor C. W. Edwards, department of physics, Duke University, and Dr. A. S. Wheeler, recently retired acting chairman, department of chemistry, the University of North Carolina. The executive committee reported the election of 38 new members since the last meeting and the reinstatement of 7 former members.

In the high-school science essay contest, sponsored by the academy, first prize was awarded to Miss Lucy Nelms, Nashville High School, Nashville, N. C., for her essay entitled "Thumbs Down on Erosion." This contest will be continued in 1938 in the fields of physics and chemistry.

Dr. John N. Couch, department of botany, the University of North Carolina, was awarded the Phipps and Bird medal for the most noteworthy paper, entitled "A Fungus that Catches Nematodes."

The American Association for the Advancement of Science research grant for 1936 was awarded to Mr. D. S. Correll, department of botany, Duke University, for the continuation of his studies of the orchids of the southeastern states. The grant for 1937 was awarded to Dr. L. G. Willis, North Carolina State Experiment Station, for the continuation of his studies on the oxidation-reduction equilibrium in soils.

A complimentary barbecue supper was served on the college lawn to the members of the academy and visitors. This was followed by a one-act comedy by the local dramatic club.

The evening meeting was presided over by the vice-president, C. F. Korstian. Howard R. Omwake, president of Catawba College, welcomed the academy. This was followed by an address, entitled "The Interdependence of the Sciences," by the retiring president, P. M. Ginnings, Greensboro College.

At the conclusion of the evening meeting, President and Mrs. Omwake entertained the officers and members of the academy at an informal reception in their home.

The forenoon of the second day was set aside for the presentation of the more technical papers, and the academy therefore met in sections as follows: General Section (botany, zoology, forestry, geology), Mathematics Section and Physics Section. The Chemistry Section did not meet at this time.

The following officers were elected for 1937:

GENERAL SECTION

President, W. E. Speas, Wake Forest College.
Vice-President, M. L. Braun, Catawba College.
Secretary-Treasurer, H. L. Blomquist, Duke University.
Executive Committee, the above officers and W. L. Porter, Davidson College; H. R. Totten, the University of North Carolina; R. F. Poole, North Carolina State College.
Representative to the American Association for the Advancement of Science, Bert Cunningham, Duke University.

CHEMISTRY SECTION

Chairman, W. C. Vosburgh, Duke University.
Vice-Chairman, Neville Isbell, Wake Forest College.
Secretary-Treasurer, E. C. Markham, the University of North Carolina.
Councilors, D. G. Hill, Duke University; R. W. Bost, the University of North Carolina.
Executive Committee, the officers and C. S. Black, Wake Forest College; W. A. Reid, North Carolina State College; Edward Mack, the University of North Carolina; W. E. Jordan, North Carolina State College.

MATHEMATICS SECTION

Chairman, J. J. Gergen, Duke University.
Secretary, Archibald Henderson, the University of North Carolina.

PHYSICS SECTION

Chairman, J. B. Derieux, North Carolina State College.
Secretary, F. W. Lancaster, North Carolina State College.

The thirty-seventh meeting of the North Carolina Academy of Science will be held in 1938 at North Carolina State College, Raleigh, N. C.

H. L. BLOMQUIST,

Secretary

SPECIAL ARTICLES

THE EFFECTS OF ALCOHOL AS INFLUENCED BY BLOOD SUGAR¹

It has long been recognized that when alcohol is taken by mouth the presence of food in the stomach influences its effects. The action of the food is purely physical; it dilutes the alcohol and slows its absorption so that the concentration of alcohol in the blood does not rise as high as it would if the stomach were empty and the absorption rapid. The observations that we have now to report introduce another similar, but heretofore unrecognized, factor. We find that the increase of sugar in the blood, which follows a meal, greatly lessens the pharmacological effect of alcohol that has been absorbed. Our investigation has been made chiefly on rats, but we have evidence that men react similarly.

Our results were obtained by determining the concentration of alcohol in the blood required to produce definite effects at various concentrations of blood sugar. This was death from respiratory failure in the case of experimental animals. To obtain valid results in any study of the relation between the concentration of alcohol in the blood and the resulting effects, it is necessary to take into consideration the factors that control the distribution of alcohol in the body. Failure to do so has led to many misinterpretations in work of this kind. The factors that control the distribution of alcohol are essentially the same as those which I established for ethyl ether.²

The intoxicating and lethal effects of alcohol arise from its action on the brain. The concentration of alcohol in the brain depends upon that in the blood reaching the brain and the rate of circulation through the brain. The effects of alcohol correspond precisely to the concentration of alcohol in the jugular blood leaving the brain and are independent of the concentrations, higher or lower, that may be found in blood drawn from other parts of the body.

Complete equilibrium throughout the body, following intraperitoneal injection of a single large dose of alcohol in a rat, may take more than an hour; short of this equilibrium wide differences may exist in the venous blood drawn from various parts of the body, due largely to differences in rate of local circulation. Thus following the injection into a rat of 20 mg of alcohol per gram, a fatal dose, blood drawn from the jugular vein at the moment of death had 9.4 mg per cc, that from the femoral vein 6.3 mg per cc, the right heart 16.0 mg and the arterial 15.8 mg. We have found, however, that, regardless of excess of the dose given or of the time required to cause death by respiratory failure or of the concentration in the blood

from the heart or peripheral veins, that in the jugular vein of fasting rats (blood sugar 0.1 per cent.) is at the moment of death always 9.0 to 9.8 mg per cc. The concentration of alcohol in the jugular blood thus affords a basis for comparison in the study of the influence of variation in blood sugar upon the lethal concentration of alcohol. It is one that is not influenced when the equilibrium of alcohol in the body is incomplete.

For confirmation of our determinations we have made measurements of dosage as well as concentrations. To do so it was necessary to develop a technique of administration by which a nearly complete equilibrium could be maintained throughout the body. Small but uniform doses of alcohol were administered intraperitoneally every 5 minutes over a period of several hours. Under the condition thus induced and maintained the concentration in the blood in all parts of the body is virtually uniform. Thus three measurable factors, time, dose and blood concentration, can be accurately determined. For the lethal effect of alcohol all three factors were found to be constant but constant only when the concentration of sugar in the blood is also constant.

The toxicity of alcohol is influenced inversely by the concentration of sugar in the blood. Thus when the blood sugar is reduced by prolonged fasting to 0.07 per cent. the lethal concentration in the blood is 8.0 mg per cc of blood; when the blood sugar is 0.1 per cent., as following a short fast, the lethal concentration is 20 per cent. higher, that is, 9.5 mg per cc. When the blood sugar is raised to 0.2 per cent. by forcing sugar the lethal concentration is 50 per cent. higher than that during starvation, that is, 12.0 mg per cc of blood. The amounts of alcohol that were administered under our technique to obtain these values are respectively 6.5, 7.75 and 11.0 mg per gram of rat. For intermediate values of blood sugar the lethal concentration of alcohol and the dose fall correspondingly between these limits. Very high concentrations of sugar, far beyond normal possibilities, obtained by injection of sugar do not increase the protective action and in some cases diminish it.

Similar experiments carried out with ethyl alcohol and with ether, which unlike ethyl alcohol are not appreciably burned in the body, showed that the concentration of sugar in the blood does not influence the lethal concentration of these substances. The presumption is therefore that the modifying effects of sugar upon the action of alcohol is in some way connected with the combustion of alcohol in the tissues.

The alcohol used in these experiments was commercial spirits, common grain alcohol. We have made additional tests with highly purified alcohol and with

¹ Read before the National Academy of Sciences, Washington, D. C., April 26, 1937.

² H. W. Haggard, *Jour. Biol. Chem.*, 59: 737-802, 1924.

some beverage alcohols. The lethal concentration in the blood is the same for all we have tested, but there is considerable difference as between alcohol from various sources in the dose required to produce this concentration, a fact suggesting a difference in the rate of oxidation.

Our observation that the concentration of blood sugar influences the pharmacological effects of alcohol may offer some explanation of the alleged idiosyncrasies in human reactions to alcohol. It affords a new factor that must be taken into consideration in any experimental study of the pharmacology of alcohol. Our technique of determining doses under conditions of equilibrium affords a method of making precise quantitative measurement of the toxicity of alcohols from various sources.

HOWARD W. HAGGARD
LEON A. GREENBERG

YALE UNIVERSITY

THE OPERCULAR APPROACH TO THE PITUITARY¹

SURGICAL techniques for the removal of the pituitary gland of teleosts have been described by Parker² in the catfish, *Ameiurus*, and by Matthews³ in the killifish, *Fundulus*. These techniques are not quite satisfactory in experiments to be carried on over long periods of time, inasmuch as the operated animals survived only for a short time; the catfish surviving only two days, and the killifish several weeks. A new approach to the teleost hypophysis whereby tissue injury is reduced to a minimum has been worked out by the author with more satisfactory results.

(1) THE CATFISH

Parker's method of hypophysectomy consisted in making a U-shaped cut through the gular membrane from the opercular opening on one side to that on the opposite side of the animal, so that the lower jaw was completely separated from the gills. Having accomplished this initial opening, the operation was completed by puncturing a hole in the parasphenoid and snipping off the gland. This method involves a two-inch incision which may be avoided in the following manner. The catfish is wrapped in a wet cloth and placed on its back under a binocular microscope. The mouth is held open by five retractors, and an incision about two to three millimeters in length is made through the mucous membrane covering the parasphenoid bone. A trephine drill is then introduced under the operculum and between the first and second gill arches. One merely lifts the operculum and gently separates the first from the second gill arch. This

procedure exposes a wide natural cavity, and the drill may now be inserted directly perpendicular to the roof of the mouth. The hypophysis can be seen through the bone as a small yellow spot. A hole (1.5 mm in diameter) is drilled through the bone, the gland sucked up in a pipette, and the wound closed by a single suture through the mucous membrane. The operation can be performed virtually without the loss of a single drop of blood and need not take over three minutes. The animal is returned to a tank of running tap water and survives for many months. Within a week, the suture disappears and the cut membrane heals over completely.

(2) THE KILLIFISH

Matthews's method of hypophysectomy involved a sub-oral route, since he first made a V-shaped incision through the branchiostegal membrane with the base of the V at the tip of the tongue. The tongue was then pulled sufficiently ventral to expose the region of the pituitary. My operations with the sub-oral route proved unsatisfactory mainly because of the size of the initial incision, and the necessary cutting of a large blood vessel running along the ventral surface of the lower jaw. These two difficulties may be avoided by the opercular approach. The fish, first immobilized by immersion in cracked ice, is placed on its left side under an operating microscope. The operculum is elevated and held by a single retractor. The first and second gill arches are separated, thus exposing a wide space directly below which the hypophysis is located. A three-millimeter incision is made through the epithelial membrane slightly lateral to the mid-line in order to avoid a median artery. A hole is drilled with a trephine drill (1 mm in diameter) and the gland sucked up in a pipette. The wound is not closed by a suture because of the proximity of the median artery, but the circular piece of bone excised by the drill may be replaced to close the wound. The operation may be performed within five minutes and if done with sufficient care is a totally bloodless operation. The animal is placed in salt water for a day and then transferred to running tap water, as Matthews recommends, or it may be placed directly in tap water at room temperature.

This approach to the pituitary gland under the operculum and between the first and second gill arches may prove satisfactory for other teleost fishes.⁴

A. A. ABRAMOWITZ

BIOLOGICAL LABORATORIES
HARVARD UNIVERSITY

⁴ Smith, Burr and Ferguson (*Endocrin.*, 19: 409, 1935), describe an orbital approach for hypophysectomy in the goldfish. These authors state, however, that their operative procedure involves enucleation of the right eye, severe traumatization of the interorbital plates, invariable rupture of an artery, blind groping for the hypophysis, traumatization of the hypothalamus and successful extirpation in one of seventeen cases.

¹ Aided in part by a grant from the National Research Council Committee on Problems of Sex administered by F. L. Hisaw.

² G. H. Parker, *Jour. Exp. Zool.*, 69: 199, 1934.

³ S. A. Matthews, *Biol. Bull.*, 64: 315, 1933.

THE APPLICATION OF SPRAYS TO EXPANDING PLANT SURFACES¹

DURING the season of 1934, the authors had occasion to make a series of measurements of the surface areas of apple fruits grown in the college orchard at State College, Pa. This work was done in connection with a study of the deposition and retention of lead and arsenic trioxide on the fruit and leaf surfaces of two varieties of apples sprayed with three spray mixtures. From these measurements and from the chemical analyses of the fruit surfaces for the two toxic elements, it was apparent that the expansion of the fruit surfaces during growth was the most important single factor operating against the maintenance of an adequate deposit for the control of chewing insects, particularly the codling moth (*Carpocapsa pomonella* L.). The effect of the growth was particularly great during the early period of development of the fruit, when the surface areas doubled in extent within four or five days. It was reasoned from this work that spray applications would be more effective in maintaining an adequate deposit if the early sprays were applied at more frequent intervals, thus compensating for this rapid increase.

During the season of 1935 ten Stayman Winesap trees in the college orchard were sprayed with a mixture containing lead arsenate 3 pounds, flotation (wetable) sulfur 5 pounds and fish oil 1 quart per 100 gallons of spray mixture. On five of the trees three applications were made at regular intervals of 14 days. On the remaining five trees applications were made at intervals of 4, 10 and 20 days following the first application. Samples of fruit were taken for chemical analyses immediately previous to and following each spray application. More extended measurements of growth rate of fruit of this and other varieties were also taken during this season, from fruit at the tops of the trees as well as from the lower limbs. Study of the results of this experiment led to the following conclusions:

(1) Growth of the fruit at the tops of the trees was considerably more rapid during the greater part of the season than of those at the bottom.

(2) Fruit from the tops of trees of the Stayman Winesap variety increased from 300 square millimeters in area to 950 square millimeters within ten days (between June 1 and June 10). The subsequent increases were progressively less rapid.

(3) In order to provide an adequate deposit on the fruit surfaces during this early period the second cover spray application should follow the first by not more than 5 days. The third application should follow the second by not more than 9 days, while be-

¹ Authorized for publication on January 26, 1937, as Paper No. 760 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

tween the third and fourth applications 13 days may elapse. Under conditions of heavy codling moth attack a fifth spray may be necessary, in which case an application 17 days after the fourth should serve to maintain a deposit adequate for protection until early in August.

While the results given above apply only to central Pennsylvania conditions and the details of the method and dates of application may vary with the locality, it is felt that such timing of spray applications is of sufficient importance from an economic and practical point of view to merit consideration by all workers who have to deal with the problem of insect control on materials of this type. The complete results will be published in the near future.

D. E. H. FREAR

H. N. WORTHLEY

ON THE STRUCTURE OF PECTIN POLY-GALACTURONIC ACID

THE fundamental problem of the structure of an oligopolysaccharide consists in elucidation of the places of union of each monose to the other and in the elucidation of the ring structure of each monose. In the special case of the pectin polygalacturonic acid, this information was lacking. We have now succeeded in demonstrating that carbon atoms 4 and 5 are engaged in the ring formation and in the condensation of each unit with its neighboring unit.

This information was obtained by degradation of the polygalacturonic acid with periodic acid which resulted in the formation of levotartaric acid which has been identified as its acid potassium salt.

For $C_4H_5O_6K$, $K = 20.78$ per cent.; Found $K = 20.70$ per cent.

$$[\alpha]_D^{25} = -22.0^\circ \text{ (in water)}$$

and for the undissociated acid,

$$[\alpha]_D^{25} = -15.0^\circ.$$

The special function of the hydroxyl groups of each of the carbon atoms 4 and 5 remains to be established. However, it is safe to predict that the hydroxyl group of carbon atom 4 serves for condensation and that of carbon atom 5 for ring formation.

P. A. LEVENE

LEONARD C. KREIDER

ROCKEFELLER INSTITUTE FOR
MEDICAL RESEARCH, NEW YORK

BOOKS RECEIVED

- DE SCHWEINITZ, DOROTHEA. *Occupations in Retail Stores*. Pp. xviii + 417. Ill. International Textbook Company.
ELDRIDGE, JOHN A. *College Physics*. Pp. x + 616. Illustrated. Wiley. \$3.75.
HILL, ALBERT F. *Economic Botany*. Pp. x + 592. 225 figures. McGraw-Hill. \$4.00.
VERNON, M. D. *Visual Perception*. Pp. x + 247. 19 figures. Cambridge University Press, Macmillan. \$4.50.
WILLIAMSON, E. G. *Students and Occupations*. Pp. xxiv + 437. Holt. \$2.50.

THE JOURNAL OF NUTRITION

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Vol. 13

Contents for February, 1937

No. 2

- G. BACHMANN and J. HALDI, with the technical assistance of W. WYNN and C. ENSOR. A comparative study of the respiratory quotient following the ingestion of glucose and of fructose as affected by the lactic acid and carbon dioxide changes in the blood. Two text figures.
- J. E. HAWKS, M. M. BRAY and M. DYE. Effect of diet on the constancy of the urinary nitrogenous constituents excreted daily by pre-school children. One text figure.
- G. STEARNS and D. STINGER. Iron retention in infancy. Four text figures.
- G. STEARNS and J. B. MCKINLEY. The conservation of blood iron during the period of physiological hemoglobin destruction in early infancy. One text figure.
- R. E. REMINGTON. Improved growth in rats on iodine deficient diets.
- A. R. PATTON. A comparison of the glycine contents of the proteins of normal and chondrodystrophic chick embryos at different stages of development.
- L. H. NEWBURGH, M. W. JOHNSTON, F. H. WILEY, J. M. SHELDON and W. A. MURRILL. A respiration chamber for use with human subjects. Three text figures.
- L. H. NEWBURGH, M. W. JOHNSTON, F. H. LASHMET and J. M. SHELDON. Further experiences with the measurement of heat production from insensible loss of weight.

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READY JANUARY 25

Culture Methods for Invertebrate Animals

Prepared co-operatively by American zoologists under the direction of a committee of Section F of the American Association for the Advancement of Science: F. M. Lutz, P. S. Galtsoff, P. S. Welch, and J. G. Needham, *Chairman*.

EARLY sections deal with general considerations of culture management. Subsequent sections give detailed methods for collecting and rearing particular groups or species. A carefully prepared system of cross-references will assist in finding the many diverse uses of the materials discussed and a comprehensive index is a key to general methods of procedure as well as to individual topics.

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENTIFIC EVENTS OF THE YEAR

(Continued)

Biology

Surgical transplantation of eyes, ovaries and other organs in insects only a sixth of an inch long was described by Drs. Boris Ephrussi and G. W. Beadle, working first in Paris and then at the California Institute of Technology.

That cells "drink" fluid from their surroundings was demonstrated by Dr. Warren H. Lewis, Department of Embryology, Carnegie Institution of Washington.

A pressed specimen of one of Gregor Mendel's famous pea plants was brought to the University of Pennsylvania from Mendel's old monastery, by Professor Samuel W. Fernberger.

The historic Lacasta-Mocino botanical collection was brought from Madrid to the Field Museum of Natural History, Chicago.

Elephants have a body temperature about two degrees lower than that of man, and a heart-beat less than half as fast as the human rate, it was announced by Dr. Francis G. Benedict and Robert C. Lee, Nutrition Laboratory, Carnegie Institution of Washington.

Evolutionary changes in a fungus were produced by secondary cosmic rays, in experiments by Drs. B. Rajewsky, A. Krebs and H. Zickler of Frankfurt-am-Main, Germany.

Heavy hydrogen and isotopes of other nutrient elements were used in tracing the transportation routes of materials in animal and plant bodies by Professor August Krogh, of the University of Copenhagen, and by Drs. R. Schoenheimer and D. Rittenberg, of Columbia University.

Cancer-provoking chemicals produced abnormal growths on plants, in experiments by Dr. Michael Levine, Montefiore Hospital, New York City.

Green light is poisonous to one-celled plants, Dr. Florence E. Meier, Smithsonian Institution, discovered.

A humane trap, that holds its catch with a chain loop instead of steel jaws, was brought out by Vernon Bailey, formerly of the U. S. Biological Survey.

The North American Wildlife Conference was formed, under the leadership of J. N. ("Ding") Darling.

All shooting of canvasback and red-head ducks was forbidden.

A juniper in the High Sierra, believed to be as old as the famous Big Trees, was studied and described by Dr. Waldo S. Glock, Carnegie Institution of Washington.

An enormous mountain laurel bush, 82 inches through at the base, was found in the Great Smoky Mountains National Park.

The great National Park in the Belgian Congo was more than doubled in size.

The number of plant patents passed 200.

Extensive field tests were made with the Rust cotton picker, and an improved model was patented.

A promising new cotton hybrid with exceedingly fine,

strong fibers, was announced by the U. S. Department of Agriculture.

Drought caused the worst crop failures in the history of the country.

Grasshoppers and Mormon crickets were very destructive in the West.

The devastating elm disease continued to spread in the area around New York City.

Milk was successfully shipped for long distances by first concentrating and then freezing it, in a process developed by the U. S. Department of Agriculture.

Experiments on a commercial scale were made with the method of growing large crops of vegetables and flowers in tanks of electrically warmed nutrient solution originated by Professor William Gericke, of the University of California.

Anthropology

PEKING MAN—inhabitant of Choukoutien caves in China over half a million years ago—was a direct ancestor of recent man, and a type independent of Neanderthal Man and far more primitive, Dr. Franz Weidenreich, Peiking Union Medical College, concluded.

"The oldest known Englishman" title was claimed for the skull which has been coming to light in successive discoveries in the Thames Valley, as a result of excavations in gravel 24 feet under ground, by Dr. A. T. Marston, London dentist and archeologist.

The verdict that a new species of fossil ape with certain man-like characters, discovered at Sterkfontein, South Africa, is probably of Upper Pleistocene age, hence contemporary with man, not an ancestral form, was announced by Dr. Robert Broom, of the Transvaal Museum.

The human race became definitely human between Pliocene and Pleistocene times, about 1,000,000 years ago, Professor Hellmut de Terra, Yale, estimated.

Seeking new light on prehistoric man in Alaska, Dr. Aleš Hrdlička, of the U. S. National Museum, explored two Aleutian burial caves containing numerous mummies, and also discovered an Aleut skull pronounced the largest normal skull known in America.

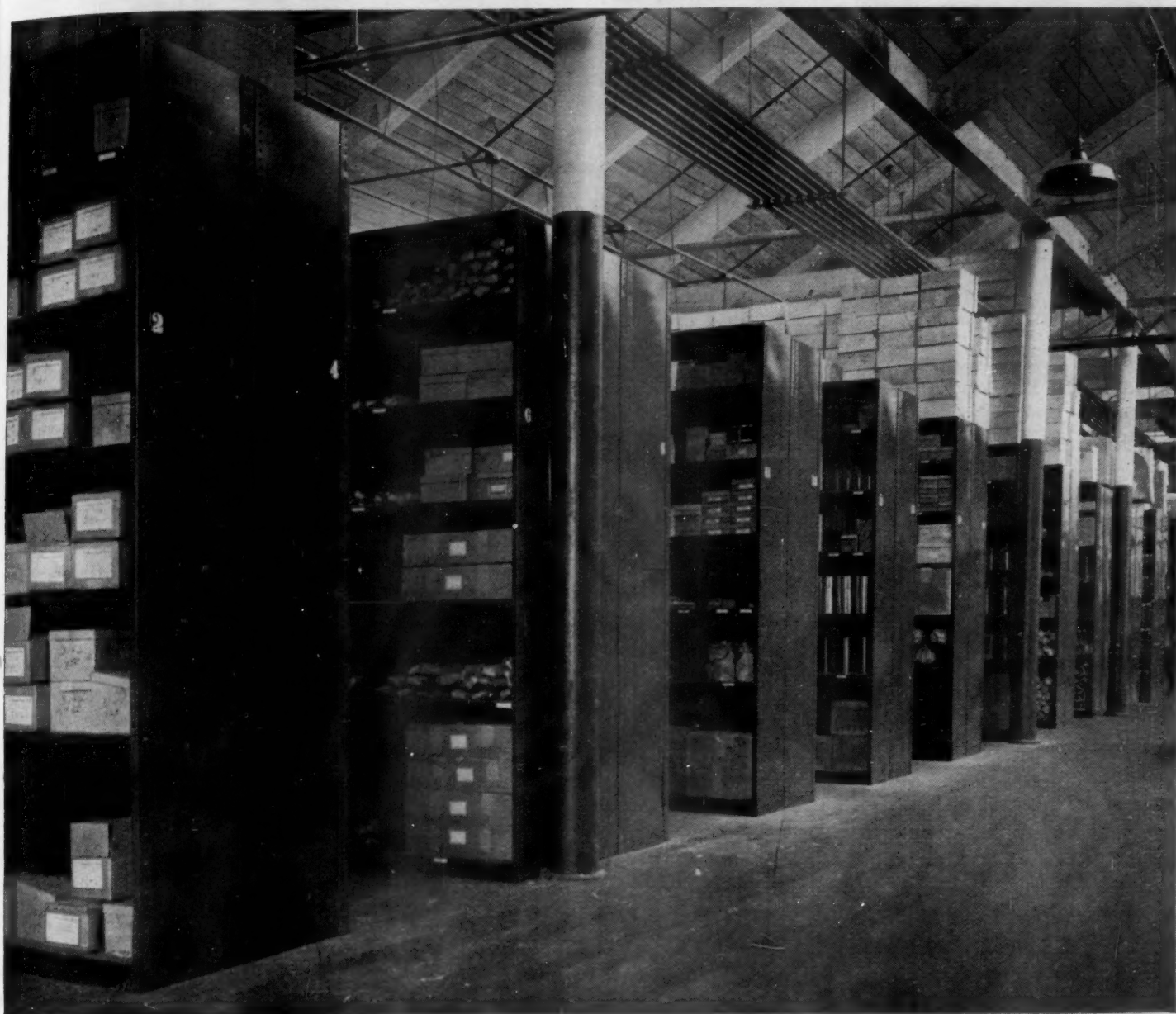
The American population includes nine physical groups, the largest consisting of Nordics mixed with other types, Professor E. A. Hooton, Harvard University, reported.

A 4-year study of New England speech, which will become part of a linguistic atlas of the United States and Canada, was completed under the direction of Dr. Hans Kurath, Brown University.

Physical traits of 2,000 Irish women and 10,000 Irish men were recorded by Harvard University anthropologists working in Ireland.

Blood types of ancient Egyptians were determined by Dr. P. B. Candela, Brooklyn physician, from their bones subjected to biochemical test.

Dr. Edgar B. Howard, leader of a joint expedition, succeeded in dating Folsom Man in America more definitely by finding man-made weapons associated with bones of prehistoric elephants and by having scientific witnesses



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LABORATORY APPARATUS AND CHEMICALS

confirm the geology and climatology as indicating antiquity of about 10,000 years for the event.

Tombs of ancient American rulers were discovered by the Carnegie Institution of Washington, in a group of Mayan pyramids in Guatemalan highlands, shedding new light on the Old Mayan Empire.

A culture in the Ulua River region of Honduras, ancestral to that of the Mayas, was unearthed by Dr. W. D. Strong, leading an expedition for the Bureau of American Ethnology and Harvard University.

A prehistoric Indian settlement described as three miles long in Ponca Creek Valley, Nebraska, was explored by Professor Earl H. Bell, University of Nebraska.

An ox cult, unique in archeological records, was discovered in the Limpopo Valley, Transvaal, Africa, when Captain G. A. Gardner unearthed a very early Bantu habitation of possibly 900 A.D. and found an ox buried with human ceremony.

Medical Sciences

Protamine insulinate, called the "most valuable discovery in the treatment of diabetes since the original discovery of insulin," was developed, for use together with ordinary insulin in treating severe diabetes, by Dr. H. C. Hagedorn and associates at Steno Memorial Hospital, Copenhagen.

Apparently one disease was transformed into another when Dr. George Packer Berry, University of Rochester School of Medicine, produced in rabbits fatal cases of the tumor disease, myxoma, by injections of killed and harmless myxoma virus mixed with the virus of non-fatal rabbit fibroma.

First synthesis of theelin, one of the female sex hormones, was reported by Professor Russell E. Marker and Thomas S. Oakwood, Pennsylvania State College.

Apparently successful use of a preparation, known as Prontosil, in the treatment of beta hemolytic streptococcus infections including scarlet fever, puerperal fever and erysipelas, was reported by Drs. Perrin H. Long and Eleanor A. Bliss, the Johns Hopkins Medical School, and in England by Dr. Leonard Colebrook, Medical Research Council, and Dr. Méave Kenny and associates, Queen Charlotte's Hospital, London. The chemical was first prepared and used in Germany four years ago.

Continuous use of the stomach tube to reduce internal pressure in the distended abdomen in cases of acute intestinal obstruction and other severe abdominal conditions was devised and its successful use reported by Dr. Owen H. Wangenstein, of Minneapolis, Minn.

Long-sought cause of mussel poisoning, which has resulted in death following the eating of California rock mussels at certain seasons, was traced by scientists at the Hooper Foundation of the University of California to poisonous phosphorescent microorganisms of the sea, *Gonyaulax catenella*, eaten by the mussels.

Detection of radium poisoning became more accurate through the application of a new type of screen-cathode quantum counter developed by Dr. Robley D. Evans, Massachusetts Institute of Technology, and said to be 10 to 100 times more sensitive than older methods of detecting radium in the body.

Better protection against dangerous x-ray burns through use of a baffle screen which deflects secondary electrons in the x-ray beam was devised by Dr. G. Failla, Memorial Hospital, New York.

A new technique for investigating living matter by obtaining characteristic electrical patterns specific for each species and which, in animals, has already shown characteristic changes in the pattern on the advent of cancer, during ovulation, and other physiological processes was devised by Drs. Harold S. Burr, Cecil T. Lane, and Leslie F. Nims, of Yale University.

Neutron rays are more effective than x-rays in killing tumors in animals and may prove more potent in destruction of cancers in humans, Dr. John H. Lawrence, of Yale University, and his brother, Professor Ernest O. Lawrence, of the University of California, reported, on the basis of studies with the atom-smashing cyclotron invented by Professor Ernest O. Lawrence.

Growth of mouse cancers was checked with hemorrhage and destruction of the tumors following the treatment with colon bacilli, meningococci and other microorganisms, Dr. H. B. Andervont, U. S. Public Health Service, reported.

Mice with spontaneous tumors lived longer and tumor growth was checked following injections of cystine disulfoxide, Dr. Frederick S. Hammett, Lankenau Hospital, Philadelphia, reported.

Cancer tissue, contrary to general opinion, requires the same sort of protein nourishment for its growth as normal tissue, Drs. Carl Voegtlin, J. W. Thompson, Mary E. Maver and J. M. Johnson, U. S. National Institute of Health, found from experiments in which growth of cancer in mice was checked by diets deficient in lysine or cystine and restimulated by glutathione.

A new strain of yellow fever virus was isolated by scientists of the International Health Division, Rockefeller Foundation, promising more effective vaccination against yellow fever.

A new hazard from yellow fever was discovered when scientists of the Rockefeller Foundation's International Health Division found that Brazilian jungle fever is a yellow fever and that other mosquitoes besides *Aedes aegypti* can carry the disease.

A chemical explanation of heart failure as a disturbance in the breaking down and rebuilding by individual heart muscle cells of phosphocreatine was worked out by Drs. George Herrmann and George Decherd, University of Texas School of Medicine.

Visual purple, chemical compound in the eye necessary for seeing, was regenerated in a test tube for the first time under controlled conditions which make possible repetition of the feat and consequent important investigations of vision, by Drs. Selig Hecht, Aurin M. Chase, Simon Shlaer and Charles Haig at Columbia University.

A test for the sense of smell and for fatigue of this sense, which may be useful in locating brain tumors, was developed by Dr. Charles A. Elsberg, Irwin Levy and Earl D. Brewer at the Neurological Institute, Columbia University.

A nervous mechanism that acts as a thermostat to

regulate body temperature was found in the hypothalamic region of the brain by Dr. S. W. Ransom, Northwestern University Medical School.

Important function of the cortex of the adrenal glands is to regulate the amount of potassium in the blood and thus keep the body from poisoning itself, Drs. Raymond L. Zwemer and Richard Truszkowski, Columbia University College of Physicians and Surgeons, reported.

Further evidence that the adrenal and pituitary glands play an important rôle in diabetes was obtained by Dr. C. N. H. Long, Yale University.

The relation of the pituitary gland to sex functions was further clarified by Dr. Herbert M. Evans and collaborators at the University of California who succeeded in separating the stimulating extract into three fractions, each of which selectively affects one of the three functional components of the ovary.

Lipocaine, new hormone from the pancreas which controls fat metabolism in the liver as insulin controls carbohydrate metabolism and may greatly improve treatment of diabetes, was obtained by Drs. Lester R. Dragstedt, John van Prohaska and Herman P. Harms, University of Chicago.

Vaccination against ivy poison by subcutaneous injections of the irritant from poison ivy plants was accomplished in a group of CCC men by Lieutenant-Colonel J. M. Blank, U. S. Medical Reserve Corps, and Dr. Arthur F. Coca, Pearl River, N. Y.

Influenza can be more widely spread through the air than previously supposed, but ultraviolet light kills the influenza virus suspended in droplets in the air, studies by Drs. W. F. Wells and H. W. Brown, Harvard School of Public Health, indicated.

A structure between the nerves and muscles of the body which acts as a barrier to the passage of a disease-causing virus which, like infantile paralysis virus, attacks the brain and central nervous system, was discovered by Drs. Albert B. Sabin and Peter K. Olitsky, Rockefeller Institute for Medical Research.

An alum-pièric acid nasal spray, developed by Dr. Charles Armstrong, U. S. National Institute of Health, was widely used as a preventive of infantile paralysis in southern states. This method was 95 per cent. effective in monkeys but the method of its employment in the southern states was such as to leave its value in humans undetermined.

Successful use of placental extract in the treatment of hemophilia was reported by Drs. R. Canon Eley and Charles F. McKhann, of Boston.

Surgical operations were performed on hemophiliacs without post-operative hemorrhage by means of high frequency electroscalpel and coagulation unit, Drs. Warfield M. Firor and Barnes Woodhall, Johns Hopkins Hospital, reported.

Incubation of egg white mixed with potassium bromide provides a remedy that markedly reduces the blood clotting time in hemophiliacs and continued use of the remedy may enable them to lead normal lives without danger of hemorrhage from slight injury or exertion, Drs. W. A. Timperley, A. E. Naish and G. A. Clark, University of Sheffield, England, reported.

Improved rabies vaccine, free from potentially dangerous nervous tissue, was made from culture virus by Drs. Leslie T. Webster and Anna D. Clow, Rockefeller Institute.

Picrotoxin is an antidote for overdoses of luminal and other barbiturates, Drs. T. Koppányi, J. M. Dille and C. R. Linegar, Georgetown University Medical School, reported.

Antidote for cyanide poisoning is injection of a mixture of amyl nitrate, sodium nitrite and sodium thiosulphate, Dr. K. K. Chen, of Indianapolis, reported.

The immediate cause of certain headaches was claimed by Dr. Temple Fay, Temple University, Philadelphia, to be the amount of fluid in the brain.

Epileptic seizures were predicted by electrical studies of the brain conducted by Drs. F. A. Gibbs and W. G. Lennox, Harvard Medical School.

Experimental production of edema of the lungs and subsequent pneumonia, such as occurs following operations, burns and toxic conditions of childbirth, was accomplished by Drs. Virgil H. Moon and David R. Morgan, of Philadelphia.

Human bone marrow was grown in glass laboratory apparatus for the first time in sufficient quantities for study of blood and metabolism by a method devised by Dr. Edwin E. Osgood and Alfred N. Muscovitz, University of Oregon Medical School.

Injecting meningococcus antitoxin into the veins instead of the spinal cavity is a more effective method of treating epidemic meningitis and reduces the number of deaths from the disease, Dr. Archibald L. Hoyne, of Chicago, found.

Allergy or sensitiveness to certain foods can be detected by a blood test, since the number of white blood cells decreases after the offending food is eaten, Dr. Warren T. Vaughan, of Richmond, reported.

Further proof that food poisoning is due to *Staphylococcus aureus*, common microorganism that also causes boils, and that cream puffs and eclairs, foods most commonly concerned, can be made safe by reheating to 156 degrees Fahrenheit, was furnished by researches of Dr. G. M. Dack, of the University of Chicago, and Dr. George A. Denison, of Jefferson Co., Ala., Board of Health.

The causative virus of epidemic encephalitis was grown outside the animal body by Drs. Jerome T. Syverton and George P. Berry, University of Rochester School of Medicine and Dentistry.

A combination of recognized fever and medicinal methods of treating syphilis, which materially shortens the necessary period of treatment, was reported by Drs. Clarence A. Neymann and Theodore K. Lawless and S. L. Osborne, of Chicago.

Sinus infections can reach the lungs via lymphatic glands of neck and chest, Drs. Ralph A. Fenton and Olaf Larsell, University of Oregon Medical School, demonstrated.

Test for predicting the outcome of operations for relief of high blood pressure, made by observing the effects on blood pressure of injection of the anesthetic, sodium pentothal, was devised by Drs. Edgar V. Allen, J. S. Lundy and A. W. Adson, of the Mayo Clinic.

MANUAL OF THE SOUTHEASTERN FLORA

ILLUSTRATED

Being Descriptions of the Seed-Plants growing naturally in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee and Eastern Louisiana

By

JOHN KUNKEL SMALL

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SCIENCE NEWS

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SCIENTIFIC EVENTS OF THE YEAR

Medical Sciences (continued)

Use of blood from the newly dead for transfusion to living persons was undertaken at the Central Emergency Hospital, Moscow, and results in nearly 1,000 cases were reported by Dr. S. S. Yudin, surgeon-in-chief.

Derivatives of morphine that are safer and more powerful than ordinary morphine were prepared by Dr. Lyndon F. Small, University of Virginia, in research directed toward development of non-habit-forming morphine. Addiction property of the new morphines has not yet been determined.

A method of preventing tooth decay by using silver nitrate to detect faults in enamel formation where decay may start was reported by Dr. E. P. Brady, Washington University Dental School.

A new alcohol, phthiocerol, isolated from the wax of the human tubercle bacillus, was reported by Professor R. J. Anderson and S. H. Stodola, Yale University, in addition to two other new alcohols, entirely different in composition from phthiocerol, isolated one each from the timothy bacillus and the leprosy bacillus.

Five wavelengths comprise the portion of ultraviolet light curative of experimental rickets by irradiation, and of these the one which is most effective rarely reaches the earth in sunshine, Professor John W. M. Bunker and Dr. Robert S. Harris, Massachusetts Institute of Technology, reported.

A method for rapid intubation of the human small intestine, developed in the medical clinic of the University of Pennsylvania, permitted the collection of pure intestinal secretion, a determination of its chemical characteristics, a study of the motor effects of morphine on the intestinal musculature and a direct investigation of glucose absorption from the bowel.

Psychology and Psychiatry

A new tool for study of the mentally ill was suggested by Dr. T. W. Forbes, New York State Psychiatric Institute, by the discovery that the psychogalvanometer, or "lie detector," can distinguish two electric waves from the skin, one of which betrays excitement in the subject even when he is unaware of feeling it.

Learning may be observed at the moment it takes place, indirectly through observation of the brain's electric potential during the process, Dr. Herbert H. Jasper, Brown University, found.

Use of the rhythmic electric impulses from the brain to locate defective areas in that organ was reported by Drs. H. H. Jasper and H. L. Andrews, Brown University.

A progressive increase in rate of human brain waves from about four and a half per second in the baby 3 months old to the adult rate of 10 or 11 per second in the 12-year-old, suggesting a parallel development of brain function, was reported by Dr. Donald B. Lindsley, Brush Foundation and Western Reserve University.

Brain waves occur in unborn guinea-pigs at least 12

days before normal birth, Drs. Leonard Carmichael, Charles S. Bridgman, University of Rochester, and Dr. H. H. Jasper, Brown University, observed.

Identical twins have identical patterns of brain rhythms, Drs. Hallowell Davis and Pauline A. Davis, Harvard Medical School, found from study of 18 twin pairs.

Brain waves may be used as a mark of distinction between individuals, Drs. Lee Edward Travis and Abraham Gottlober, State University of Iowa, found.

The hypnotic trance is not the same physiologically as natural sleep, electric potentials from human brains under the two conditions demonstrated by Drs. E. Newton Harvey, Princeton, Alfred L. Loomis and Garrett Hobart, Loomis Laboratory.

Effects of sedative and other drugs upon the brain are partially revealed by the brain's electric potentials, Dr. W. G. Lennox and Dr. and Mrs. F. A. Gibbs, Harvard University Medical School, found.

Possible use of brain waves as a tool for understanding mental deficiency was suggested by Dr. George Kreezer, Vineland Training School, who found differences in the brain rhythm pattern of Mongolian defectives below six-year mental age.

Injury to the brain cortex causes loss of mental plasticity and also of ability to make a general attack on a problem, this loss being independent of the location of the injury but proportional to its extent, Dr. I. Krechevsky, University of Chicago, learned from animal experiments.

The centers of the brain controlling instincts were located by Professor E. Grünthal, Würzburg University, Germany, in the part of the brain known as the thalamus and hypothalamus.

The reflex leg movement ordinarily made by a rat startled by a noise can be "forgotten" if the noise is repeated, it was found by Drs. Walter S. Hunter, Brown University, and C. Ladd Prosser, Clark University, who demonstrated that spinal reflexes can be extinguished and then restored.

Ability of a person to adjust the frequency of a tone until it appears exactly half as high in pitch as another was demonstrated in experiments by Drs. S. S. Stevens and J. Volkman, Harvard University, and Dr. E. B. Newman, Swarthmore College, who built a numerical scale of psychological pitch in this way.

Experimental confirmation of the theory that tones of differing pitch are distinguished because they affect different areas of the ear's basilar membrane was obtained by Drs. Hallowell Davis, S. S. Stevens and Moses H. Lurie, Harvard University. Dr. Stevens also found that the human ear can act as radio loud speaker, converting electric impulses of the radio receiver into tunes readily identified by the "listener."

Decreased sugar in the blood increases acuity of hearing, Dr. W. J. Brogden, University of Illinois, found by x-raying the pituitary glands of dogs and by experiments with a diabetic patient.

Animals are sensitive to temperature before birth, but

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the sensitivity increases during the fetal period, Dr. Leonard Carmichael, University of Rochester, found from experiments with guinea-pigs.

Monkeys have color vision equal to man's, a fact of significance to the theory of evolution, Dr. Walter F. Grether, University of Wisconsin, found.

Refined division of labor in the nervous system was demonstrated by Dr. Karl U. Smith, University of Rochester, when he observed that cats have one type of vision controlled by the visual area of the brain cortex and another dependent upon a more primitive part of the nervous system.

A 14-year-old boy retains some impression of poetry read to him in infancy, it was demonstrated experimentally by Dr. Harold E. Burt, the Ohio State University.

Startle, such as that produced by a revolver shot, causes two distinct types of emotional response—first an instantaneous involuntary and universal reaction and second a more individual socialized behavior—ultra-rapid motion pictures revealed to Dr. William A. Hunt, Connecticut College for Women, and Dr. Carney Landis, Columbia University.

The uncertainty principle of physics, which opposes the concept of determinism, was extended to include psychology by Professor Niels Bohr, physicist of Copenhagen.

Because of the way doses of glandular secretions change behavior, Dr. Roy G. Hoskins, Harvard University, proposed that "chemical conditioning" should be accepted as a new psychological principle.

Size of a social group has an important effect upon the tendency of an individual to dominate, the weaker one of a pair often becoming dominant in a larger group, Dr. A. H. Maslow, Columbia University, found from study of monkeys.

Chimpanzees can be taught to use gestures and vocalization to solicit aid from another animal in a cooperative task, Dr. Meredith P. Crawford, Yale University, found.

Rudimentary, or undeveloped, speech centers were found in the brains of the three highest apes—orang-utan, gorilla and chimpanzee, by Dr. Cornelius J. Connolly, Catholic University of America.

Seven primary elements of human intelligence were named by Dr. L. L. Thurstone, University of Chicago, as number facility, word fluency, visualizing ability, memory, perceptual speed, induction and verbal reasoning.

The functioning of attitudes in human conditioned reactions make learning thereby a very different process in human beings from what it is in animals, Dr. G. H. S. Razran, Columbia University, concluded.

Capacity for mental work is impaired at an altitude of 17,500 feet, Dr. R. A. McFarland, Columbia University, found as a member of the International High Altitude Expedition to Chile.

A mathematical genius of the lightning calculator sort was produced from an ordinary college student by giving him 75 hours of practice and special training by Drs. Samuel Renshaw, William C. Schwarzbek and Otis D. Knight, the Ohio State University.

A scale for measuring social competence, especially useful in testing those suspected of mental deficiency, was

developed by Dr. Edgar A. Doll, Training School, Vineland, N. J.

Phenobarbital, a commonly used hypnotic drug, retards learning of rats but does not affect their forgetting, Dr. Griffith W. Williams, University of Rochester, found.

Fever and also increased blood pressure and pulse rate can be produced by suggestion, Dr. M. Kershaw Walsh, University of South Carolina, reported.

Insulin was used in Europe to treat the mental disease schizophrenia, and it is claimed restored patients to sanity.

Disturbance of a part of the brain, the hypothalamus, may be the primary factor in the important mental disease schizophrenia, Drs. Isidore Finkelman and Daniel Haffron, Elgin, Ill., concluded from evidence that the hypothalamus controls oxygen consumption and other body mechanisms which are upset in the mental disease.

A new form of functional nervous disorder attacking only airplane pilots and called therefore aeroneurosis was reported by Dr. Harry G. Armstrong, U. S. Army Medical Corps.

Patients can be brought out of the death-like stupor of schizophrenia by hypodermic injection of brandy, Drs. N. V. Kantorovich and S. K. Constantinovich, Medical Institute and Psychiatric Hospital, Leningrad, reported.

A surgical procedure which blocks off a portion of the impulses to and from the prefrontal lobes of the brain was used successfully to relieve symptoms of chronic mental disease by Drs. Walter Freeman and James Watts, George Washington University Medical School. The operation was first devised by Dr. Egas Moniz, of Portugal.

Success with treatment of mental disease patients in groups rather than individually was reported independently by Drs. Paul Schilder and Loretta Bender, Bellevue Hospital, New York City.

An individual's manner of breathing is characteristic and may reveal certain emotional and physical derangements and unconscious desires, experiments showed Drs. Leon J. Saul and Franz Alexander, Chicago.

A new Committee for the Study of Suicide was organized in New York.

A new scientific organization, the Society for Psychological Study of Social Issues, was formed for the purpose of applying psychology to research on problems in the fields of politics, economics and relations between nations.

ITEMS

NEED of commercial aviation for immediate and detailed weather information is bringing about a revolution in weather service for non-flying purposes. The new type of weather reporting is of course costlier than the old, but it is absolutely indispensable if flying is to be carried on in safety. And now the same kind of weather information is beginning to be appreciated as valuable by shipping interests, farmers, dairymen, promoters of athletics and other forms of outdoor entertainment, and many other people.

HIGH-FREQUENCY radio on earth "goes blotto" when violent outbursts of hydrogen gas explode on the sun. This phenomenon, first observed by Dr. J. H. Dellinger,

of the National Bureau of Standards, has been carefully re-investigated at the Mount Wilson Observatory, using a long series of spectroheliographic plates. Records of several similar outbursts, at the observed interval of about 54 days, each lasting 15 minutes, were found. The correlation between hydrogen eruptions and radio fading is not infallible, however, for at least one pronounced eruption occurred without a corresponding fadeout. Our sun, which is a small star as stars go, and rather dim, too, has more brethren of its own kind in the heavens than have hitherto been suspected to exist.

DR. DEANE B. JUDD, of the National Bureau of Standards reports that a seasoned incandescent lamp when burned at constant voltage will gradually change color and gradually become more yellow in the light it emits.

DR. JOHN W. FINCH, director of the U. S. Bureau of Mines, points out that even without any new discoveries and with a continuation of the high 1935 consumption the proved resources of natural gas are sufficient to last 40 years.

HATCHABILITY of hens' eggs is definitely improved when the scrap meat included in their poultry ration contains a high proportion of liver, is indicated by experiments of investigators at the U. S. Department of Agriculture.

AN institute for research in animal psychology has just been opened in Munster, Westphalia, under the directorship of Dr. Werner Fischel. It is at present the only establishment of its kind in Germany; similar institutes already exist in the United States and the Netherlands.

A HYDROELECTRIC power plant built entirely under water is the boast of the town of Rostin in Pomerania. There is no powerhouse on the bank, no visible structure anywhere; everything lies in midstream below the dam, and the electricians come and go through tunnels. The underwater powerhouse is a by-product of a flood problem set by the Persante River. Its early spring freshets, bearing rafts of battering ice, formerly flooded many acres of fertile land. To reclaim this land the river's meandering course was straightened and shortened, and a low dam was built near Rostin.

HOFRAT J. WREGG, writing in *Die Umschau*, states that Hameln in Hanover, a small city of 28,000 inhabitants, claims the honor of being the world's first community to rid its city gas supply of the dangerously poisonous carbon monoxide. This is done by mixing the gas as it comes from the producers with hydrogen, and passing over a catalyst that combines the two into harmless, readily combustible methane. Instead of the 21.4 per cent. of carbon monoxide once present in Hameln's city gas, there is now only about one per cent.

ERNEST N. MERRILL and George A. Young, both of Long Beach, Calif., have been granted a patent for a depth "thermometer" for taking the temperature thousands of feet underground. From readings already ob-

tained, scientists have been able to make a rough estimate of the age of the oldest rocks, and to infer from this result that the amount of heat which is being supplied to the earth from radioactive minerals may be much less than heretofore supposed. They have found, also, that generally the western part of the United States is hotter underneath than the eastern part of the country. This result is in agreement with the conclusions of the historical geologists that the Rocky Mountains are younger than the Appalachians.

PERSONS who are no longer permitted to buy gold have now turned to the still more expensive metal platinum for their efforts, according to *Industrial and Engineering Chemistry*. On June 1 the price of platinum was \$35 an ounce. By mid-September it was \$70 an ounce. A month later it was down to \$50 an ounce. Where once these fluctuations would have caused concern in chemical markets they have little affected the chemical industry because the precious metal is not so essential as it once was.

FORMING an evolutionary link between sponges and corals, cup-shaped animals inhabited a sea that covered the present site of the Appalachian mountains 500 million years ago. A great mass of their fossil remains has been found near Austinville, Va., by Dr. Charles E. Resser, of the Smithsonian Institution. These animals secreted limestone, as many sea creatures do, and with lime-loving seaweed of their age (the Cambrian) they were the world's first reef-formers. They are known to science as *Archaeocyathineae*, which is Greek for "old cup-bearers."

PLANT remains representing twenty-seven distinct species found in a Pleistocene, or Ice Age, deposit near Fairbanks, Alaska, have been identified for the American Museum of Natural History, New York City, by Drs. Ralph W. Chaney, of the Carnegie Institution of Washington, and Herbert L. Mason, of the University of California, working in the university laboratories. All but two of the plants represent species still living. Among the better known kinds are dandelion, buttercup, cinquefoil, phlox, sedge, birch, poplar, willow, spruce and three species of fungi.

DR. ALEXANDER WETMORE, assistant secretary of the Smithsonian Institution, reports that pigmy birds lived alongside their larger brethren in the mild climates of the middle and upper Miocene Age, 40 million years ago. Among fossils of this age, which he has been called upon to examine, are a falcon no bigger than a modern male sparrow-hawk, a parrakeet only three quarters the size of the existing species, and a distant relative of the turkey, known as the *chachalaca*. The fossil pigmy form of this latter bird was only about half the size of the species that still lives in Texas. Dr. Wetmore ascribes the great abundance of bird species at that time, and the frequent appearance of pigmy forms along them, to the easy climatic conditions. When ice ages made life harder the species least able to meet the new conditions died off, leaving the diminished bird fauna of to-day.

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Contents for February, 1937

No. 1

- H. TUGE. The development of behavior in avian embryos. Two plates.
 YÜ-CHUAN TSANG. Visual centers in blinded rats. Five plates.
 A. E. WALKER. A note on the thalamic nuclei of *Macaca mulatta*. One text figure.
 H. KUHLENBECK. The ontogenetic development of the diencephalic centers in a bird's brain (chick) and comparison with the reptilian and mammalian diencephalon. Eight text figures and six plates.
 G. von BONIN. A first study of the size of the cells in the cerebral cortex. Two text figures.
 L. S. KING. Cellular morphology in the area postrema. Four plates.
 D. BODIAN. An experimental study of the optic tracts and retinal projection of the Virginia opossum. Twenty-two text figures.
 D. ATLAS and W. R. INGRAM. Topography of the brain stem of the rhesus monkey with special reference to the diencephalon. Twenty text figures.
 R. G. WILLIAMS. The development of vascularity in the hindbrain of the chick. Two text figures and two plates.
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SCIENCE NEWS

Science Service, Washington, D. C.

THE SIZE AND SHAPE OF THE UNIVERSE

WHAT is the size of the universe and what is it like in its shape? Dr. Edwin P. Hubble, of Mount Wilson Observatory of the Carnegie Institution of Washington, proposed two answers in a lecture in Washington on January 5, on the topic "Our Sample of the Universe." From studies with the world's largest telescope now in use—the Mount Wilson 100-inch-diameter instrument—the observable portion of the universe is now a giant astronomical sphere with a radius of 400 million light years.

Studies so far made seem to present a choice of two kinds of universes: (1) a small expanding universe which is finite in extent but unbounded and (2) a universe indefinitely large that is not expanding appreciably but which contains some unknown principle of nature. The explanation chosen to account for the observed reddening of the light from the most distant nebula fixes the choice of these two alternate points of view. If the reddening, or red-shift, so-called, is considered due to the expansion of the universe, then a curvature in space has to be brought into the picture to account for the observed density distribution. Otherwise the density of distribution would increase outward systematically in all directions and our own stellar system would be left in a unique position. At the present time, the curvature is positive and very large, so that if the red-shifts measure expansion then the universe is finite in size and very small. In fact the present radius of spatial curvature would be just less than the present penetrating power of the 100-inch reflector.

Of the alternative concept of the universe's size, Dr. Hubble indicated that if the red-shift is not due to expansion but to some yet unknown principle of nature which does not involve actual motion, then the true distribution of nebulae is sensibly uniform. And since the observable region is homogeneous, the universe, presumably, is so vastly greater than the observed sample that no positive inferences can be drawn. Thus a choice is offered between a small expanding universe and a universe of immense but unknown dimensions plus a new principle of nature. It is possible that the theory (expanding universe postulated by Abbé Lemaitre) may be generalized to include new models. Otherwise, the probabilities, at the moment, seem to favor the greater universe, although a definite choice will doubtless await more powerful methods or still greater telescopes.

LIFE AND MAGNETISM

THAT human life is in some way bound up with the great force of magnetism has long been a speculation. "Personal magnetism" is a pseudo-scientific phrase which shows one form of this type of speculation. At the recent conference at Princeton University on molecular structure, a true scientific basis for linking magnetism and life was discussed. And the link appears to take place in the blood and makes possible the body's respiration.

Dr. Worth H. Rodebush, of the department of chemistry of the University of Illinois, told of the rôle the magnetic property of oxygen plays in life. Oxygen supports respiration by permitting the oxidation of the blood's impurities at relatively low temperatures. But if it supported all forms of combustion as it does respiration the whole world would shortly burn up, for all dry organic matter would quickly be consumed. Something of the paradoxical behavior of oxygen is shown by its position in the periodic table of the chemical elements, where it stands between the inert gas nitrogen, on one hand, and the extremely reactive gas fluorine, on the other. Oxygen, in other words, has a considerable amount of chemical activity and affinity and yet not too much. A possible clue to the paradoxical behavior of oxygen is found in the fact that, of all the common elementary diatomic gases, oxygen alone is paramagnetic, gathering in a magnetic field, and hence reacts readily with other magnetic materials, such as the iron in the hemoglobin of the blood. Because of the magnetic characteristic of oxygen it does not react so readily with the non-magnetic substances like cellulose and the hydrocarbons. And thus spontaneous combustion does not occur at ordinary temperatures. Yet within the human body, the reaction between oxygen and hemoglobin, by which the impurities in the blood are burned, takes place readily without raising the temperature above body heat.

SPRAY-CONTROLLING LAWS

ALL apple-growing states should have their own state laws to protect resident apple eaters from the dangers of poisonous spray residue. Recommendations for such legislation appears in a research report in the current issue of *Public Health Reports*, official publication of the U. S. Public Health Service. The recommendation for spray control legislation by states is made by Dr. Ralph Heeren, of the University of Iowa.

Investigating the poison spray residue situation in Iowa, Dr. Heeren and his associate, Helen B. Funk, found that fruit from some orchards had spray residues definitely higher in amount than the safe limit set by the U. S. Department of Agriculture. This limit is 0.018 grain lead residue per pound of fruit. Samples from some of the orchards gave values as high as 0.024 and 0.027 grain per pound of fruit. Most samples, however, yielded lower values than the 0.018 safety limit. If the lead residue is higher than this limit, government scientists believe there is enough lead in arsenic on the fruit to be "potentially dangerous to the consumer."

Sprayed fruits and vegetables shipped in interstate commerce are subject to federal inspection. Fruits and vegetables sold within the state where they are grown are without this safety control and only a few states have laws of their own pertaining to regulation of amounts of spray residue. It would appear that all apple-growing states should enact laws giving the state department of health

power to protect consumers against spray residues by controlling amounts of lead present on fruit offered for sale. As a further precaution all sprayed fruits should be washed in a one per cent. hydrochloric acid rinse which has been shown to be an effective and simple means of reducing lead loads.

REPORT OF THE AERONAUTICS COMMITTEE

POINTING with pride to the present remarkable development of American aviation, founded upon fundamental scientific research, the National Advisory Committee for Aeronautics in its report to President Roosevelt, transmitted to Congress on January 11, urges the wisdom and ultimate economy of increased research appropriations to insure that this country shall not fall behind. "Commercial aeronautics is more highly developed in the United States than in any other country," the report states. "Military aircraft developed in the United States are highly efficient and dependable."

Major European nations are placing tremendous emphasis on the military significance of aircraft. Their construction programs and factories are being enlarged and research laboratories and facilities multiplied. While the National Advisory Committee for Aeronautics laboratories at Langley Field, Va., are on the whole as yet unexcelled by those of any other single nation, the maintenance of American leadership becomes more difficult in the face of tremendous expansion of research facilities by foreign nations. Because the large seaplane is becoming an important factor in the development of transoceanic air transportation and of long-range naval aircraft, the present National Advisory Committee for Aeronautics seaplane towing tank of 2,000 feet length is having approximately 900 feet added to it. It will then accommodate water speeds of up to 80 miles per hour. A large pressure type wind tunnel is also being built. By increasing the pressure in the tunnel to three or more atmospheres, relatively large models can be tested under conditions that will give results more nearly corresponding to the actual performance of large airplanes flying at high speed than it is possible to obtain in any wind tunnel in the United States at this time. The new 500-mile-per-hour wind tunnel placed in operation during the past year has more than met its designed performance.

Regular seaplane service across the North Atlantic will soon be inaugurated, the report predicts. It also observes that the economic status of air transport is improving to such an extent that cargo airplanes are being developed for freight only.

AVIATION ENGINEERING AND MOTOR BUS DESIGN

A NEW light-weight motor bus, designed, engineered and built by aviation personnel, seized the spotlight of discussion at the Detroit meeting of the Society of Automotive Engineers. The economies achieved with these motor coaches in experimental operation promise to greatly increase borderline profits with heavy, present-day equipment.

The achievement of the new coaches after several hun-

dred thousand miles of operation are: gasoline mileage cut in half for an ordinary coach of similar seating capacity; tire mileage of 60,000 miles a set, and brake lining lasting 40,000 miles.

The new buses, which bring a clean break with automotive conception of engineering and apply the lessons learned by aviation, were conceived by William B. Stout. They were described at the technical sessions of the Society of Automotive Engineers by Stanley E. Knauss, of the Gar Wood Industries, Inc., of Detroit. To get rid of vibration, noise, heat and odors for the passengers the new coach has its engine in the rear. And it has special springs instead of truck springs now in use which tend to give a truck ride. A twenty-four passenger bus weighs only 6,500 pounds because its framework is of metal tubing, welded throughout. The light weight permits smaller power plants to be used and the auxiliary transmissions and clutches which are readily available by present mass-production techniques. Repair shops for such motors are plentiful and the bug-a-boo department of most bus operators—the stock room—can virtually be eliminated.

APPLICATION OF MACHINERY TO THE FARM

MECHANIZATION of the farm as one of the basic factors in the growth of America was a topic at the Detroit meeting of the Society of Automotive Engineers. Harry G. Davis, director of research of the Farm Equipment Institute, Chicago, showed that in 1820 it took 83.1 per cent. of all workers in the nation to operate the farms. In 1900, after animal-powered farm machinery had been perfected, it required only 35.5 per cent. of the workers to operate the farms. In 1930 only 21.5 per cent. of the workers were needed on the farms, due to the advance of mechanization, particularly in the replacement of the horse by motor power. Whole industries to-day could not exist if the former man power on the farm had not been freed. Thus, internal combustion and Diesel engines in the form of tractors and power plants decreased the needed farm labor a very sizable amount, even when compared with the extraordinary revolution which occurred with the use of machinery like the binder and reaper.

Comparing the figures for change from 1820 to 1900 with the change from 1900 to 1930, it can be shown that in the latter thirty years the impact of motor-driven farm machinery accounted for a decrease of 69 per cent. in the needed farm workers. For those who cry that mechanization of the farm has been a contributor to depression troubles, Mr. Davis pointed out that the elimination of a single machine like the cotton gin would break the nation as it now exists. If we were to do away with this machine and did not reduce our production below the average of the past ten years, it would require 37,000,000 people, working 8 hours a day for 300 days a year, to separate by hand the seed from the cotton lint. About a fourth of the entire population would be needed, therefore, to get out the cotton crop alone. While tractors first came into being to draw farm machinery formerly pulled by animals, the newer trend has been to design both machinery and its power unit as a single coordinated whole. Im-

proved operation and economy has resulted from this move. There are still 3,000,000 farms of 50 acres or more in the United States that could use farm mechanization. And there are a million more which could use more of the newer, smaller models.

ITEMS

UNOFFICIAL reports of influenza outbreaks in New York City, Minneapolis and Chicago have reached the U. S. Public Health Service in Washington, but figures from the entire nation show that there is no general epidemic. For the week ending December 26, the latest for which reports are in, state health officers throughout the country reported a total of only 2,088 cases. This figure may be below the actual total, since influenza is a disease for which it is almost impossible to get accurate reports. New York State outside of New York City, for example, does not collect influenza case reports at all. In the local outbreaks influenza cases are a little higher than usual for this season, but have not reached the high figures of the epidemics of 1928 and 1932. These outbreaks began about the first of December, a fact which makes it seem unlikely that they are the forerunners of a wide-spread epidemic. The history of flu epidemics, it was pointed out, shows that they generally begin as early as October.

INVESTIGATORS at the National Bureau of Standards are searching for some new transparent plastic material which will be strong enough to serve as an airplane windshield for those accidents where a bird flies against it. Another need is for a drinking cup material for use in prisons so that lethal weapons can not be easily obtained as with present heavy crockery.

To protect the eyes of the welder from the blinding light of the electric welding arc, a Lexington, Ky., inventor, H. F. Montague, has invented and just obtained a patent for a new type of fool-proof welder's hood. The instant the wearer of such a hood touches the piece of metal with the welding rod, a protective screen instantaneously covers the window of the hood to filter out the blinding rays that would otherwise reach the welder's eyes. The moment he lifts the rod—stops welding—the screen snaps away from the window so that without tilting or lifting the hood, the welder can inspect the work. Operation of the screen is made automatic by special electric mechanism in the hood, which is controlled by the current that operates the arc.

A DEVICE that automatically records the ups and downs of a bumpy airplane flight has been developed by the National Advisory Committee for Aeronautics, it was reported to the Society of Automotive Engineers. Richard V. Rhode, research engineer of the National Advisory Committee for Aeronautics laboratories at Langley Field, Va., explained the operation and recording of his so-called V-G recorder which shows the simultaneous effect of air speed and the acceleration of gravity during a gusty flight. By an ingenious coupling of levers which activate a stylus rubbing on smoked glass, the National Advisory Committee for Aeronautics recorder gives a permanent record of how the effect of gravity combines with airspeed. In both land transports and seaplanes the

device has now taken records for over 20,364 hours in the air and traveled over 3,500,000 miles in doing it.

At the symposium on molecular structure of matter sponsored by the American Chemical Society at Princeton University, Drs. Walker Bleakney, E. U. Condon and L. G. Smith, of Princeton University, told how electrons may be shot at gas molecules at small velocities and energies equivalent to only 20, 30 or 35 volts and fundamental molecular problems solved. Significance of the research is that: It is primarily concerned with the number of ways in which a molecule may be broken up, the energies necessary for these transformations, and the probabilities of their occurrence. A new discovery in this field is that when a single electron hits a many-atom molecule like benzene—with its six carbon and hydrogen atoms—all the hydrogens may be stripped off. The entire binding force which holds the benzene molecule together is completely overcome by the impact.

IN connection with Science Service report on the Research Parade demonstration of the effects of thymus extract on rats, Science Supplement, December 4th, Dr. Leonard G. Rowntree would like to make the following corrections. The facts are as follows: (1) Preliminary experiments with the injection of pure glutathione indicate that it may produce a similar effect to that of thymus extract on growth and development of the young of the second generation. (2) Glutathione has been detected in our potent preparations of thymus extract. The administration of thymus extract and glutathione was by injection and not by feeding.

CHINCH BUGS are in winter quarters in "moderate to very large" numbers through central Illinois, southern Iowa, northern Missouri and eastern Kansas. Smaller hibernation-numbers are reported across Ohio almost to the Pennsylvania line and south into Arkansas. The bugs live over winter in wayside grasses, ready to migrate to small grain crops as soon as the fields develop in spring. Later, they shift to corn. Whether the bugs will prove the pest next summer they did in 1934 is still an uncertainty. It will depend on the weather, particularly on whether it rains during their times of migration. The bugs are favored by hot, dry weather in late spring and early summer. Wholesale burning of fieldside and roadside grasses is not recommended as a means for getting rid of them. It is not always effectual, and in the long run may do more harm than good by destroying cover needed by wildlife valuable to the farmer. Changes in field planning, especially planting more soybeans and other legumes, which chinch bugs do not touch, are suggested as good control measures.

THE nearly complete fossil skull of an entirely new kind of extinct titan-beast, or Titanotheres, recently found in the Death Valley region of California, is reported to the National Academy of Sciences through its official *Proceedings*, by Dr. Chester Stock, of the California Institute of Technology. The animal's head in life must have been nearly three feet long, for the skull has an over-all measurement of about 28.5 inches. It was found in a geological stratum of Oligocene Age, estimated at approximately fifty million years ago.

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SCIENCE NEWS

Science Service, Washington, D. C.

RED-SHIFT IN LIGHT FROM COSMIC SOURCES

THE theory of cosmogony of the expanding universe, which postulated some primeval explosion that sent the stars and galaxies rushing apart, was critically discussed at the scientific meetings at the University of Notre Dame, on January 10, honoring the memory of the chemist and botanist, Father J. A. Nieuwland, whose basic discoveries led to the development of synthetic rubber-like compounds.

Professor Arthur Haas, Viennese theoretical physicist now on the staff of the university, presented mathematical arguments and calculations showing that the famous observed red-shift of light from the distant nebula can hardly be due to an expansion, or rushing away, of these cosmic bodies from some central point. The interpretation of the red-shift as due to a velocity of motion has been the backbone of the expanding universe theory so often associated with the name of Abbé G. Lemaitre, the Belgian scientist-priest. Professor Haas calculated the amount of energy which matter can create in a unit volume of the universe and finds it far too little to overcome the gravitational attraction that must be overcome if the different parts of the known universe are rushing away from one another in a super-expansion. Professor Haas supported his arguments by also making calculations showing the amount of energy per gram of matter which would be required to double the mutual distances between nebulae in a system of mutual density. His conclusions from this calculation were:

"A nebular system which exhibits the average mass density observed in the extra-galactic region and which has already experienced a doubling of its linear dimensions, can not possess a radius of more than about 6,000 million light years. This result seems remarkable because, if in the nebular system there is any expansion at all, we must assume that at least a doubling of the linear dimensions has already taken place. This conclusion can not be evaded since a doubling requires only 1,300 million years, whereas the age of some terrestrial minerals was found to be 2,000 million years."

If astronomers abandon the idea that the reddening of the light from the distant nebula is due to their velocity of expansion then some other concept must be introduced to account for the observed red-shift. Somehow or other the light from these far-away nebula has to lose energy *en route* so that its color is slightly redder than it was when it started. One idea would be that intergalactic dust in the path would absorb some of the light ray energy. But Professor Haas demonstrated by calculation that the loss of radiant energy is of the same order of magnitude as the energy-production of matter. And he concluded by showing that every photon of radiant energy—whether it has high energy and short wave-length like an x-ray or low energy and a long wave-length like a radio wave—loses the same energy in travel-

ing one single wave-length. This concept would account for the observed red-shift in light from distant cosmic sources.

PHOTONS

GHOSTS have often been suspected of being at the bottom of strange happenings on this earth. But the main claim of the modern scientist is that he has dispensed with such supernatural explanations for earthly events. In the world of modern science a ghost would indeed be a lonely individual! Nevertheless, some of those fundamental entities of which the material world is believed to be composed behave in a very very strange way. Those "bundles of energy" called photons are perhaps the worst offenders. Even the physicist is somewhat at a loss when it comes to explaining the antics of a photon. And as far as the layman is concerned—well, perhaps a photon is as much like an old-fashioned ghost as it is like anything else!

Such seems to be—for purposes of popular explanation—the view of Dr. W. F. G. Swann, of the Bartol Research Foundation who, speaking informally at the Franklin Institute recently said:

"A bullet is a kind of thing which can only be at one place at once and which strikes where it is. The electrons and protons (material particles) are like bullets. A ghost is a creepy kind of thing which can be everywhere always, which only strikes at one place at a time, but which can strike anywhere." And this unpredictable, ghostly, kind of behavior is characteristic of a photon.

Carrying the analogy still further, the speaker went on to describe how these photon-ghosts terrify the inhabitants of the atomic world. Particularly potent in this respect are the high-powered ones which accompany the cosmic rays. When an especially horrendous photon-ghost meets up with an unsuspecting atom, except for a severe "mathematical fright," the atom comes through the ordeal without serious harm. But the ghost himself may be so dreadfully annoyed that he actually materializes—comes to life—in the form of particles of matter. New-born "particles with a punch" are formed which go tearing through the atmosphere ripping the outer structure off other atoms.

A NEW PROPERTY OF MATTER

WHAT may be an entirely new property of matter has been discovered in one of the world's rarest minerals known as "Hackmanite." Found originally in the rugged fiords of Greenland in the early years of the last century and later in the old crater of Italy's volcano Vesuvius, Hackmanite has long been a treasured collector's piece for scientific museums, for its rarity alone. Now a clear variation of the deep blue, lapis lazuli-like mineral may take on the added merit of research value.

The American mineralogist, O. Ivan Lee, of Jersey City, N. J., has made the strange discovery that a

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quickly passing red-violet colored streaking of the surface of Hackmanite can be revived at will by radiating the mineral with ultra-violet rays. For many years mineralogists have known that when a clear variety of Hackmanite was fractured, characteristic and beautiful bright red-violet splashes of color appeared on the clean surface. Then, on exposure to ordinary light, they passed away. Radiation with ultra-violet light, Mr. Lee has found, brings back this lost property at will and as many times as one wanted to perform the experiment.

The first thing which one might think of to explain this strange revival of a color-death would be fluorescence. But this phenomenon is not fluorescence, at least in the ordinary sense of the term. The fluorescence of Hackmanite, that is, its brief temporary glowing following exposure to light, is a characteristic salmon pink that can not possibly be confused with the bright red-violet shade of the revived colors. Neither is the happening one of phosphorescence since this property of Hackmanite yields a beautiful blue color. What really is the true explanation of the effect is thus unknown at present, but at this stage of scientific research when supposedly the external properties of matter, at least, are well known, the discovery takes on added interest. Mr. Lee calls the phenomenon reversible photosensitivity.

Besides the Greenland and Vesuvius regions where Hackmanite is found, varieties of it have also been located on the Kola Peninsula in Arctic Russia and just recently in the province of Ontario, Canada, near Bancroft. The Academy of Natural Sciences Museum has now under shipment from Canada a specimen of this strange, rare mineral.

EFFECTS OF CARBON MONOXIDE GAS

RISKING their lives for the past six months in an effort to learn more about the effects on the human body of carbon monoxide gas, one of man's deadliest enemies, six "human guinea pigs" of the Harvard Fatigue Laboratory have found that the average man can stand the gas only until his blood is one-third saturated with it. At the same time they confirmed previous findings that very tiny concentrations of the gas can bring man to this breaking point. Only one part of the gas in a thousand parts of air, for example, breathed for half an hour or so, can render a healthy man unconscious. That is, if he is not active—if he is driving a car, for example. If he is exercising vigorously, he will succumb even sooner. They also added significant biological proof of a familiar lesson, a lesson emphasized by the mounting toll of deaths from carbon monoxide poisoning throughout the nation. It is the fact that the insidious poison gives absolutely no warning of its presence or even that it is stalking its prey.

Not only is the gas colorless and odorless, as has been known for some time, but in addition, it has been found, a man breathing it feels no ill effects, not even drowsiness. He just collapses without warning. If he is driving his car, if he is alone in a garage, he may well be doomed. Most dramatic proof of this was brought to the Harvard experimenters when Dr. W. H. Forbes,

of the Fatigue Laboratory, suddenly fainted after he had just completed tests requiring a high degree of skill. Other workers had to carry him from the gas-filled chamber and revive him. His blood proved to be almost one half saturated with carbon monoxide. The experiments, conducted cooperatively with the Harvard Bureau for Street Traffic Research, were directed by Dr. David B. Dill, assistant director of the Fatigue Laboratory; Dr. Harry de Silva, of the bureau; Dr. Forbes and F. M. Van Deventer, of the Cities Service Refining Company, whose survey to the effect that about five per cent. of automobiles and closed trucks examined on highways have dangerous concentrations of carbon monoxide led to the research. These men and two students volunteered for the tests.

The plan of the experiments was to admit the deadly gas in known concentrations and amounts into a closed room in which the subjects were being tested at regular intervals for their reaction time, judgment, perception and other automobile driving skills. Blood samples were also drawn at intervals to determine the percentage of saturation with the gas. In all experiments the subjects showed no decrease in skill even when their blood was about one third saturated and they were practically ready to collapse. Tests were limited to these simulated driving conditions, although it is hoped ultimately to extend the investigation to include tests directly concerned with the operation of automobiles.

FATE OF ALCOHOL IN THE BODY

THE alcohol that gets into a man's body after a cocktail party or on other occasions may be burned like food and thus disposed of. More likely, however, it is changed into some other substance which is either stored or used by the body. The exact solution of this problem of what the body does with alcohol remains a challenge to physiological chemists. Dr. Thorne M. Carpenter described in a lecture at the Carnegie Institution of Washington his own experiments which point to the conclusion that instead of being burned in the body, alcohol is converted into some other substance which may then be either stored or used.

Alcohol itself can not be stored by any organ. The amount present in any organ after drinking depends chiefly on the amount of blood circulating through the tissues of that particular organ. The highest amount of alcohol per unit of weight goes into the blood, after it has been taken into the body, and nearly as large an amount per unit of weight is found in organs well supplied with blood such as brain, kidneys, spleen, heart, lungs and liver. What happens to the alcohol between the time it gets into the blood and organs and the time it disappears from the body is the question scientists have yet to settle. Hormones, produced by the glands of the body, may be concerned in this alcohol question. Other investigators have found that injections of insulin, the diabetes remedy, make alcohol disappear very much faster than normal from the bodies of animals. In fact, the disappearance is so fast that it does not seem possible it could be due solely to burning of the alcohol.

Other conditions besides an excess of insulin may make alcohol disappear quickly, Dr. Carpenter suggested, adding that further investigation along these lines is needed.

Performance of muscular work did not hasten materially the disappearance of alcohol from the bodies of the men who drank measured amounts of alcohol. An hour's work on the ergometer did not work off all the alcohol. The only effect work or exercise could have would be to remove some of the alcohol by simple vaporization through the breath. But not very much alcohol is dissipated this way. Dr. Carpenter said that any such attempt to remove alcohol through increased ventilation "would require a perfect whirlwind through the lung in order to be really effective in diminishing the amount of alcohol in the body." Getting rid of alcohol by drinking large amounts of water also does not, in the light of Dr. Carpenter's experiments, seem a successful method. Gallons of water would have to be taken immediately after the alcohol, he found, in order to flush the alcohol out of the body. The amount of alcohol gradually diminishes by itself, he explained, and "there would be no point in taking large quantities of fluids when the alcohol had reached a low point." Other interesting points about alcohol were described by Dr. Carpenter. It is absorbed very rapidly, distributed very rapidly through the body, and has the unique characteristic of being identifiable in the body as long as any of it is left. Alcohol furnishes energy, the amount being between that furnished by fat and that furnished by sugars and starches. It can get into the body without being drunk, since it is very readily absorbed from the air by breathing.

A NEW 1,000,000 VOLT X-RAY MACHINE FOR CANCER RESEARCH AND TREATMENT

THE newest aid of science in the fight on cancer is the giant 1,000,000 volt x-ray machine of the Institute for Cancer Research at Columbia University. The uniqueness of the new development, which makes it an improvement over previous apparatus having a comparable voltage, is that it is completely housed in a large steel tank which is continuously evacuated. Both the voltage generating circuits and the x-ray tube are thus shielded from any possible accidental contact. Patients are protected, in addition, by four inches of lead which permits only a narrow beam of x-rays to strike them at the proper places for x-ray therapy. Five outlet openings for the rays are provided: four for patients and one that is reserved for research purposes. The cost of the apparatus was \$25,000.

The pressing search of science for improved ways of splitting the atom and studying its intricate nucleus is directly responsible for the new Columbia x-ray machine. In 1934 Dr. D. H. Sloan, at the University of California, developed a similar apparatus for accelerating charged particles in atomic bombardment experiments. It was found, shortly, that by a simple change of only one essential part of the apparatus it was possible to make a highly compact and efficient x-ray machine of high voltage. Such an apparatus was built for the University of California Medical School and the present Columbia

equipment is copied and improved in design over this prior equipment.

In operation the new type x-ray machine utilizes 15,000 volts of alternating current electricity and applies this to twin radio oscillator tubes generating radio waves 50 meters in length, in the shielding tank. The electrical circuit of these tubes is so designed that when resonance is obtained more than 200,000 watts of electrical power flows in the hollow copper tubes of the equipment. Swift-flowing streams of water help dissipate the great heat generated. Eight hundred thousand volts potential have been obtained in Dr. Sloan's original apparatus and it is anticipated that the Columbia equipment will go beyond this to 1,000,000 volts. Upper potential limit of the design is limited only by the effectiveness of cooling the enclosed apparatus. Potential 5,000,000 volts could be obtained with existing oscillator radio tubes if there were any way of cooling the apparatus and making it work without burning up.

ITEMS

THE "lost" Asiatic earthquake of Thursday, January 7, has been located in Tibet by scientists of the U. S. Coast and Geodetic Survey, working on data collected by wire and radio by Science Service. Its epicenter was in approximately 35.5 degrees north latitude, 97.5 east longitude. This is in the general region of the Kwen Lun mountains, and apparently in an uninhabited or sparsely inhabited area. The disturbance was exceedingly severe, so that if it had occurred in the neighborhood of any large settlements the toll in death and property destruction would have been heavy. Fifteen seismological observatories in the United States, Canada, the Philippines and China supplied the data. They are as follows: Pennsylvania State College; Seismological Observatory, Pasadena, Calif.; Franklin Institute, Philadelphia; University of Montana, Butte; Des Moines, Iowa, Seismological Observatory; the Dominion Meteorological Observatory, Victoria, B. C.; the Manila, P. I., observatory; the observatories of the Jesuit Seismological Association at St. Louis University, Canisius College, Fordham University, and Zikawei, China; the observatories of the U. S. Coast and Geodetic Survey at Tucson, Ariz., Sitka, Alaska, Honolulu, T. H., and Chicago, Ill.

A NEW and direct international air route between Moscow and the United States, that traverses Soviet and U. S. territory exclusively, is being discussed. The projected route would be about 10,000 miles long. With good airports and modern high-speed airplanes it could be traveled in 4 or 5 days. Crossing the sub-arctic regions of Siberia, this route has already been pioneered by the Soviet aviators Levanevsky, Levchenko, Molokov and others. From Moscow the line would run to Krasnoyarsk, or Irkutsk, thence to Yakutsk, then to Ayan, next to Nagayevo until Anadyr on the Pacific Ocean is reached. The planes would fly across to Nome in Alaska and then to Seattle via Fairbanks and Juneau. One advantage of the new air link is that it would provide communication between the capitals of the Soviet Union and the United States without the need of traversing the many frontiers of Europe or any other foreign countries.

SCHOOL AND SOCIETY

EDITED BY J. McKEEN CATTELL

CONTENTS

DECEMBER 26

The National Association of State Universities: Static or Dynamic: A. H. UPHAM.

Educational Events:

The Australian Council for Educational Research; Court Decision on the Election of Regents of the University of Minnesota; A Research and Service Bureau at New York University; Petition of Teachers College, Columbia University, for the Continuation of Federal Theater Projects; New Fellowships of the Julius Rosenwald Fund; The National Association of School Secretaries; Charges Preferred against President Glenn Frank, of the University of Wisconsin; The Installation of President Wriston, of Brown University.

Educational Notes and News.

Shorter Articles and Discussion:

1937 as a Centennial Year in the History of Education: WALTER C. EELLS. *Democratizing the Secondary-School Curriculum:* REID E. JACKSON. *Are the Private Schools and Colleges to Share?:* G. O. TAMBLYN.

Special Correspondence:

Educational Progress in Foreign Countries: S. W. DOWNS.

Quotations:

Revolution by Taxation.

Reports:

Improving Secondary Education through Group Discussion.

Educational Research and Statistics:

The General Intelligence of College Stutterers: M. D. STEER.

JANUARY 2

The First National Conference on Educational Broadcasting: Readin', Ritin' and Radio: H. L. ICKES.

Report of the Conference: D. J. SHANK.

Educational Events:

The British School Journey Association; School of Classical Studies of the American Academy in Rome; Budget of the University of California; Report of the Treasurer of Yale University; The Alexander Fleet Memorial Fund; Fellowships at Teachers College, Columbia University; The Twenty-third Annual Meeting of the Association of American Colleges.

Educational Notes and News.

Shorter Articles and Discussion:

Skills as Outcomes of Teaching the Social Studies: C. A. HARPER. *Marshall College Centennial:* J. E. ALLEN.

Special Correspondence:

Higher Education in the Netherlands: H. BEAUMONT.

Educational Research and Statistics:

The Effect of Federal Emergency Relief Administration Employment upon College Grades: MAZIE E. WAGNER, H. P. EIDUSON and R. J. R. MORRIS.

EDUCATIONAL REVIEW

Edited by WILLIAM McANDREW

Comment on Things Educational:

Front Seats.

Monthly Survey of Educational Books.

Index to Volume 44.

JANUARY 9

The Future of the Catholic University of America: J. M. CORRIGAN.

Fear—the Master Enemy: A. O. BOWDEN.

Educational Events:

The Land-Grant Colleges and Universities; The Municipal University of Omaha; Chicago Junior Colleges; A New California County Library; The Plimpton Library at Columbia University; The Gift of the General Education Board to the University of Chicago; Broadcasts in Contemporary History; Convention of the Association for Childhood Education.

Educational Notes and News.

Shorter Articles and Discussion:

Educational Planning: E. O. SISSON. *The Transfer of Teachers in the Cincinnati Public Schools:* E. D. ROBERTS. *"The Murder of Mexican Teachers":* B. IDDINGS BELL.

Quotations:

Tempest in Wisconsin.

Reports:

State of the Schools and Activities of the Office of Education during the Past Year: J. W. STUDEBAKER.

Educational Research and Statistics:

Circulation of Daily Newspapers, 1935: M. SMITH.

JANUARY 16

Founders' Day Address at the Drexel Institute of Technology: J. H. PENNIMAN.

The Demands of the Present Crisis upon the High School: C. W. TAUSSIG.

Educational Events:

Legislative Appropriation for the University of Minnesota; The Finances of Columbia University; Mr. Mellon's Gift for a National Gallery of Art; Graduate School of Banking of the American Banking Association; The Bureau of Reference, Research and Statistics of the New York City Board of Education; The American School of the Air; The Earliest Library Schools.

Educational Notes and News.

Shorter Articles and Discussion:

Changing Criteria for Testing College Teachers: R. L. KELLY. *We are Stimulated:* O. W. CALDWELL and Wm. CROCKER. *Congressman Blanton's Questionnaire:* C. B.

Quotations:

The Dismissal of Dr. Glenn Frank.

Societies and Meetings:

The New Orleans Convention of the Department of Superintendence: B. FARLEY. *Midwinter Conference of the American Library Association.*

Educational Research and Statistics:

College Aptitude of Adult Students: E. J. McGRATH and L. A. FROMAN.

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SCIENCE NEWS

Science Service, Washington, D. C.

HUMAN RESEMBLANCES IN FOSSIL APE BONES

NEW points of resemblance between man and the recently discovered higher-ape fossils of Sterkfontein have been worked out by their discoverer, Dr. R. Broom, of the Transvaal Museum, Pretoria, South Africa. As more and more of the bone was cleared from its encasing stony matrix, new details of the cheek bone, thus made visible, showed that the animal had less of an ape-like snout and a straighter, more "human" facial angle than Dr. Broom had at first supposed. The eye teeth are relatively small, and there is no gap between them and the first pre-molars—again a man-like rather than an ape-like character. In general, the new findings support his earlier opinions and those of Professor Raymond A. Dart, of Witwatersrand University, that this extinct genus of apes was not related to any living type of great apes and shows a closer approach to the human physical make-up than do any other known apes.

Dr. Broom considers his specimen to be sufficiently different from the much more ancient one found by Professor Dart to justify a separate name for it. He proposes the zoological title *Australopithecus transvaalensis*. Since first reporting discovery of skull fragments, brain cast and teeth, a year and a half ago, Dr. Broom has also found bones of most of a hind leg, the base of a spinal column and one bone of a pelvic girdle. These are still embedded in a stony matrix, awaiting the tedious job of drilling, chiseling and scraping them free. As soon as he can find time to do this, he expects to be able to form some idea of the animal's posture in walking—whether stooped far forward like an ape, or more nearly erect like a man.

SYNTHETIC RADIOACTIVE MATERIAL USED TO TREAT DISEASE

FOR the first time a synthetic radioactive substance is being used to treat disease. This became known when injection of radiosodium into two sufferers from leukemia was reported by Drs. Joseph G. Hamilton and Robert S. Stone, of the University of California Medical School. The clinical value of the radium-like treatments was pronounced inconclusive, but these experiments are expected to pave the way for further tests upon this disease and also cancer, which leukemia is like in some respects. The radiosodium used was made by the bombardment of sodium chloride with hearts of heavy hydrogen (deuterons) shot out by the powerful cyclotron devised by Professor Ernest O. Lawrence, of the University of California.

Radiosodium was seized upon for medical use because it promises to have the beneficial effects of radium and other natural radioactive substances without their dangers. Radium and its salts if injected into the human body become fixed in the body tissues and continue to bombard them until death is caused, usually in a few years. This is not possible with radiosodium, as its

activity is over in a few hours instead of continuing for many years. The half-life of radiosodium is only 14.8 hours. This short duration of radiosodium's activity made necessary speedy team work between the physicians and the physicists in the leukemia experiments just reported. Sodium chloride was bombarded, rushed to the hospital, dissolved in water, boiled, filtered, tested for activity, and then injected into the veins of the patients who were men 29 and 23 years old. Incidentally this use of radiosodium gives science a new method of measuring what the human body does with sodium, so important in our daily food. Because the radio sodium "broadcasts" radioactivity, delicate instruments can be used to detect where it travels and what it does.

BRIGHTNESS OF VARIABLE STARS

DURING the past 32 years, over half a million measurements of changes in the brightness of eclipsing variable stars have been made at the Princeton Observatory. Approximately 300,000 of them have been made by Dr. Raymond S. Dugan, professor of astronomy at Princeton University and president of the Commission on Variable Stars of the International Astronomical Union. He is generally regarded as having the most accurate photometric observing eye in the world. Authoritative light curves of 19 eclipsing variable stars have been published by Professor Dugan. One of them was based on a series of over 14,000 measurements, and for another he took observations over a period of nine years in order to obtain the necessary data. The process of making each measurement involves adjusting a photometer so that the eclipsing variable star and another star of constant luminosity appear equally bright. Although a measurement can be made in less than a minute, the exacting nature of the work restricts the number that can be made during one observation period, and weather conditions usually permit measurements on only about 100 nights a year.

Eclipsing variables are "double stars" which are so close to each other, astronomically speaking, that they could not be distinguished individually by a telescope a hundred times more powerful than any in existence today. Some of these stars are much bigger and brighter than the sun, but they are so far away from the earth that only a few can be seen with the naked eye. The stars, many of which are stretched by mutual attraction into a shape resembling a football, eclipse each other once in every revolution, and the measurements are designed to determine the length of the eclipses, which star is the larger and brighter and whether the eclipses are total or partial. Professor Dugan has observed pairs which eclipse each other six times every day, and one in which the eclipses last about two years and occur at 9,883-day intervals.

Observers in many parts of the world are now investigating this field of astronomy, and Professor Dugan seeks to keep them acquainted with the latest information and to coordinate their efforts whenever possible. Since he began his work in 1905, the number of definitely known

variable stars has increased from 50 to approximately 1,000 and new ones are being discovered at the rate of about 100 each year. Further aid in deducing variations in the periods of eclipse is being obtained through the cooperation of the Harvard Observatory, where photographic material on the subject was compiled as far back as 1890. Miss Frances W. Wright, of the Princeton Observatory, is now engaged in examining these plates and comparing the results obtained by visual and photographic means.

AIR CONDITIONING

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NEW medical aids by air conditioning in the treatment of disease, houses insulated in winter by the use of ice roofs, scientific studies that seek the answer to the perplexing question "What is a draft?" and research to improve the "liveliness" of air, were topics discussed at the meeting of the American Society of Heating and Ventilating Engineers in St. Louis.

More and more the science of medicine and the profession of engineering are joining forces to combat one major avenue by which disease still spreads. It has been found that hay fever and its kindred ailments yield to treatment in controlled air-conditioned rooms. Now a new committee of the society has been organized to investigate the purification of air in hospitals to prevent infection. A hospital, it is pointed out, goes to great lengths to sterilize its operating rooms, wards, instruments and the wearing apparel of the staff. Air conditioning for increased comfort to the patients and staff is now used in many places. But very few hospitals attempt to kill organisms in the air of the operating rooms or infectious wards for respiratory diseases. Yet science knows that radiation of specific wave-lengths can kill bacteria floating about in air. But the matter of turning this academic knowledge into engineering practice on an economical basis is a real and serious problem. Tied in with medicine also, in the field of physiology, is the major research problem of answering the simple question, "What is a draft?", or, said another way, "When is a draft not a draft?" On the answer to this question rests, in many ways, the future usefulness of forced ventilation—with either heating or cooling—which is the growing trend in making enclosed places more livable.

Admittedly home-air conditioning by mechanical refrigeration is luxury, and for a few years it may remain so. But already simple, less costly forms of ventilating engineering are coming into wide use. These will so demonstrate their usefulness that true air conditioning is not too far away in time or price. Growing in use are the forced air heating systems through small ducts which distribute cleaned, heated and moisture-controlled air throughout a home. When the owner wishes, it is not too difficult to tap into this system and add refrigeration.

FROST RESISTING SOUTH AMERICAN POTATOES

NONE of the agricultural crops in Europe suffers from such a great number of diseases as the potato. Hundreds

of thousands of centners of potatoes perish every year from various diseases and from cold. At the same time the importance of this crop is growing yearly. Potatoes have become not only one of the staple food and fodder crops, but also a rubber-bearing plant, since synthetic rubber is now made from potato alcohol. In the USSR the area under potatoes reached 7,000,000 hectares in 1936. It is quite clear how important was the problem of creating varieties of potatoes which will resist disease and cold.

This problem can now be considered as solved. In the search for new stable varieties of potatoes the All-Union Institute of Plant Cultivation sent a number of scientific research expeditions to South America, the native land of potatoes. During six years, since 1926, the Soviet investigators thoroughly explored vast territories from California down to Southern Chile, where a great number of varieties of potatoes, both cultivated and wild, are concentrated. The last of these expeditions was in 1932-1933.

During the past three years the institute has studied the collected varieties and in 1935 published an extensive work entitled "South American Varieties of Potatoes," summing up the results of the work.

It appears that hitherto Europeans practically have not known potatoes because only a few varieties, brought to Europe from Chiloe Island (southern Chile) in the seventeenth century, have been at their disposal. The entire modern European and North American potato culture originated from these few tubers.

Around the isolated Indian villages in Ecuador, Peru, Bolivia, etc., seventeen cultivated varieties of potatoes, quite unknown, were found.

Besides, a great number of wild varieties have been discovered in Mexico and the Andes, which proved particularly valuable, as they resist phytophthora, the most dreaded disease of potatoes.

Now, as a result of long experimentation, these varieties have been crossed with the usual potato in the experimental fields of the All-Union Institute of Plant Cultivation, and in 1926 the cross-breeds were sent to the fields of the Soviet collective and state farms.

In the mountains of Peru and Bolivia, at heights of 4,000-5,000 meters, was found a remarkable wild variety, "acaule," which is capable of resisting frost of 17 degrees Fahrenheit, and which can be successfully grown in the Transarctic region. Native potatoes suffer from the early spring and autumn frosts even in the central belt of the USSR.

The institute is now completing its work on the creation of a new hybrid by means of crossing native varieties with the South American wild varieties. The new cross-breed gives a high yield and resists disease and cold. One of such hybrids is already being cultivated, this year, in Khibiny, in the Transarctic region.

The cultivated varieties of the Peruvian and Bolivian potatoes, distinguished by their high yield, are also used for crossing with the old European varieties, and a great quantity of the most valuable sowing material has already been evolved.

PRAIRIE GRASS ROOTS

Roots are formed at the rate of two miles a day by an average clump of one of the wild prairie grasses of the West. When the plant is two years old, it has nearly 320 miles of roots, probing through a mass of soil seven feet deep and four feet square.

These figures on the root "mileage" of crested wheat grass were presented at the meeting of the Botanical Society of Washington, by T. K. Pavlychenko, of the University of Saskatchewan. Mr. Pavlychenko was born in Ukraina, but for several years has been a Canadian citizen. He has thus had long experience in two of the world's greatest grass-land areas, the steppes of Russian Eurasia and the prairie-plains region of western North America.

Crested wheat grass, the subject of his special study, was introduced from western Siberia into the plains area several decades ago, as a means for combating weeds which were spreading at an alarming rate in the old cattle country. The grass proved to be not only a very successful weed control and a good forage plant but also a remarkably efficient binder of the soil against the wind erosion that starts dust storms.

In the investigation Mr. Pavlychenko first dug down around the whole column of roots of one of the two-year-old wheat-grass tufts. That took a week. Then he carefully wrapped the whole thing in burlap, to keep it from crumbling. Then he enclosed the column in a kind of sectional cage, cutting the bottom loose from the floor of his trench. With the aid of assistants, he lifted the whole mass out, tilted it over sidewise, and laid it in a big tank. He poured in water, and let it soak for two days, until the soil was soft.

Then his real work began. Beginning at the bottom of the tank he directed a fine, brush-like spray of water, washing the soil away and exposing the intricate curtain of roots without breaking even the smallest branches. Inch by inch he worked, and as he cleared the roots he plotted on square-ruled paper, making a complete chart of the whole root system. This job, of washing and charting from bottom to top, took two weeks. The charts were then measured and the total length, 319 miles, obtained.

Mr. Pavlychenko's laborious piece of root-research is believed to be the first that has ever laid bare every inch of the whole fine-branched root system of a plant. Fellow-scientists looked on his specimen, laid out in a wide, shallow tank, with something like awe.

Mr. Pavlychenko pointed out that his method of root study can also be used to good effect on plants other than grasses. It might be a good technique to follow in studying the nitrogen-capturing root nodules of legumes, or for the investigation of diseases attacking plants underground. He has already made use of it in the study of the root systems of the weeds which the crested wheat grass is being used to crowd out.

FRANK THONE

ITEMS

Two large groups of sun-spots, each a flaming cyclone in the solar atmosphere, have been photographed recently by Dr. Loring B. Andrews, of the Harvard

Astronomical Laboratory. These whirlwinds constitute the greatest activity on the sun for some time, although the present outburst is merely the forerunner of increased activity in the immediate future, building up to the periodic maximum three years hence. The larger of these solar storms stretches along the surface of the sun for approximately 125,000 miles, while the other is about 70,000 miles in length. Several smaller groups have also been detected. The effects of these outbursts are shown by such terrestrial phenomena as auroral displays, magnetic storms and improved or hampered long-distance radio reception, all of which are dependent on the electrical conditions of the atmosphere.

USING special pendulums of fused silica, the most precise measurements on the absolute determination of gravity ever made have just been announced by the National Bureau of Standards. Dr. Paul R. Heyl and Guy S. Cook performed the measurements which fix the acceleration of gravity at Washington to be 980.08 centimeters per second. For years the measurements made at Potsdam, Germany, in 1906, have been the international base determination by mutual consent of scientists. Although the Washington scientists made fewer observations than did the German investigators, the accuracy of individual readings is higher so that the average valuable obtained is comparable in accuracy. The new Washington value differs from the value at Potsdam by 2 parts in 100,000. Whether the new value will be widely accepted, as was the 1906 in Germany, can only be determined by the future.

A PHOSPHORUS-CONTAINING material, relatives of which are found in the human brain and liver, has been isolated by Drs. Erwin Chargaff and Michael Levine, of the College of Physicians and Surgeons of Columbia University and Montefiore Hospital, from the body of a bacillus that causes tumors in plants. In plants there is a well-known disease, the crown-gall, which bears a slight resemblance to tumors in animals. It is produced by the *Bacillus tumefaciens*. Using the chemical methods developed by Dr. R. J. Anderson, of Yale University, who recently purified an acid from *tubercle bacilli* which produces symptoms of tuberculosis itself when injected into an animal, they are engaged in analyzing the crown-gall germ. Their first results show that it contains a phosphatide which stimulates rapid cell multiplication in plants. They are now working to learn the exact constitution of this chemical.

AN instrument resembling the organ, which produces sounds of oriental music as well as those of western music, has been invented by A. S. Ogolteyets. The octave of this instrument has 17 intervals. Demonstrated before the Academy of Sciences of the USSR, the new instrument won high praise. Soviet musical inventors have produced interesting results by using electricity to intensify the sound of violin and guitar music. Recent electric musical instruments introduced include the emirton, violena and equodin.

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SOME PAPERS READ AT THE ATLANTIC CITY MEETING OF THE AMERICAN ASSOCIATION AND ASSOCIATED SOCIETIES

A NEW theory of atomic structure that may allow physicists to understand better the composition of matter was presented to the American Association for the Advancement of Science by Professor George D. Birkhoff, of Harvard. It is called "a conceptual theory of atomic structure" and may recall to modern approval fundamental ideas that were first presented by James Clerk Maxwell. At the Philadelphia meeting of the association in 1926 Professor Birkhoff presented a paper showing how the fundamental wave equation, which had been discovered by Schrödinger within a few months, could be arrived at in an entirely different manner. This was done on the basis of a conceptual theory of matter and electricity. This paper won the \$1,000 prize for the 1926 meeting. The principal characteristics of this theory were the following. A relativistic space-time was employed as the background for a certain "perfect fluid" which was the carrier of positive or negative electricity. In this fluid the disturbance velocity was that of light. The fluid was further endowed with a certain "atomic potential" which gave rise to a new term in the energy tensor of the fluid. In addition the positively and negatively charged portions of the fluid could freely interpenetrate. It was then shown that with suitable simple choices of the disposable quantities the same spectral frequencies would be obtained for the hydrogen atom as arise from the Schrödinger wave equation when use is made of the Planck-Einstein law. However, in the further development of the theory considerable difficulties arose and it has only been recently that Professor Birkhoff has studied the mechanism of radiation. Very significantly it has turned out that the arbitrary introduction of the Planck-Einstein law can be dispensed with. Whether or not his modified theory proves to be ultimately serviceable to physicists as an actual atomic model, it presents suggestive points of interest which it is hoped will stimulate further studies of the same kind. Such studies ought to be made since the possibility of conceptual relativistic models has not been thoroughly explored. If an acceptable model could be found which corresponded to reality, physicists would be forced to revert to the concept of the atom as bearing the stamp of the "manufactured article," in the sense of James Clerk Maxwell.

DR. HARLAN T. STETSON, of the Massachusetts Institute of Technology, suggested to the section on astronomy of the American Association for the Advancement of Science that the sun and moon may both be responsible agents for causing the apparent distance between New York and London to vary during the day and year. Dr. Stetson, on eliminating the effect of the moon by averaging intervals of observation from new moon to new moon, has been able to show that there results a curve of an annual variation in longitude with a maximum about January 1, when the earth is nearest the sun, and a mini-

mum about July 1, when the earth is farthest away from the sun, actually some four million miles farther distant. From three years' observations (1929-1931), it appears that London on the average was 39 feet farther from Washington on New Year's than on the Fourth of July. This is about two thirds the value (63 feet) which was attributed to the effect of the moon four years ago. Just how much of the 63 feet then supposed due to the moon may be indirectly laid to the sun, Dr. Stetson would not say until further investigations make possible a more complete separation of the effects of the principal disturbing sources. There is as yet no adequate explanation of the phenomenon. Since the greatest distance in general has occurred in winter, it is obvious that the effect is not due to a direct heating of the northern hemisphere or its atmosphere.

A NEW method that can record the slightest change in the gases that go in and out of a plant, measuring differences as small as one part in a million, was described by its inventor, Dr. E. D. McAlister, plant physiologist at the Smithsonian Institution, Washington, D. C. It depends on the use of the invisible infra-red rays, measuring them after they have passed through the carbon dioxide, water vapor or other gases under study, and keeping a continuous record of all fluctuations. The amount of radiation of certain wave-lengths thus absorbed is an indication of the abundance of the gas that is absorbing it. Carbon dioxide absorbs one group of wave-lengths, water vapor another, and so on. The new method is the first ever used that can keep such a continuous record, and it can be used on the breath of animals as well as the gaseous exchanges of plants. Possible uses of the new method are manifold. For instance, it has never before been possible to tell what happens in a green plant that has been in darkness, during the first few seconds after the light has been turned on. Also, it has been proved for the first time that light shining on a plant does not make it use up its foodstuffs any faster than it does in darkness. One curious phenomenon in plants, discovered by the new method, may eventually have considerable practical importance. It has been found that turning the light on and off, on and off again, at short intervals, produces a rate of carbon dioxide use in making food quite different from the rate that obtains under usual conditions of continuous sunlight.

RESEARCHERS into the brain from the standpoint of behavior held a symposium under the leadership of Dr. Leonard Carmichael, of the University of Rochester, a pioneer in the study of brain waves. The electrical impulses from the brain, which may be tapped and recorded as wavy lines, can be thought of as broadcasts from the brain, capable of giving real information as to what is happening there. The old picture of the brain as a telephone exchange, through which the sense organs "dial"

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Microdissection: Free-hand Manipulations.

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Chemical Agents: Vital Stains.

Nathan Chandler Foot

Chemical Agents: Supravital Stains.

Florence R. Sabin

Chapter III. Bacteriological Methods. *H. J. Conn*

Sectioned Material.

F. B. Mallory and Frederic Parker, Jr.

Chapter IV. General Botanical Microtechnique.

William Randolph Taylor

Fats.

Sophia H. Eckerson

Chapter V. Cytological Methods.

C. E. McClung, E. Allen, R. T. Hance and J. W. McNabb

Special Methods.

E. V. Cowdry

Chapter VI. Embryological Methods.

C. E. McClung, Ezra Allen and Ruth McClung Jones

Chapter VII. Histological Methods. Methods of Studying Red Blood Cells.

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the muscles and give them orders, is still true in a limited sense. But the brain has inner forces newly discovered. It has its own "inter-office" communicating system which joins the cerebral cortex, generally thought of as the thinking and directing part of the brain, with the thalamus, which has responsibility for those unthinking "automatic" functions such as digestion, emotion, perspiration, temperature regulation, heart beat and breathing. Just as a business executive keeps in constant communication with his office manager, so a continuous mutual exchange of messages goes on between these two parts of the brain. And this is independent of the flow of signals coming in from the outside and going to the acting parts of the body. Man's brain takes on new dignity. It is no passive mechanism set in motion by stimulating forces from the outside and lapsing into inaction again when these forces cease to bombard the senses. The brain is now viewed as a reservoir of stored energy which is released rather than created by the messages sent by the sense organs.

FIVE out of each hundred unemployed persons can never get jobs because they are totally unfit psychologically for work. Another eighty-five will be fit for employment only after long periods of training and possibly psychiatric treatment. Only ten are now actually fit for placement in industry should jobs be found for them. This scientific assay of the human resources in America's great group of unemployed was presented to the association by D. R. Shearer, who based his figures on the study of unemployed at the psychological clinic of the Tennessee Eastern Electric Company, Johnson City, Tenn. The unemployed group was drawn from the population of a town of about 30,000 persons in which more than ten per cent. are out of work. Statistical techniques were used to adjust the figures obtained in an effort to make them more truly representative of the total unemployed population. No precision was claimed for his figures by Mr. Shearer. He presented them because they give a rough idea of the unemployment problem as it is seen from the scientific, rather than the emotional or armchair theorist's angle. The urgency of a further pushing of this scientific approach was urged. The large group which consists of those who are now unemployable but may be developed to a point where they can be absorbed into industry and into various lines of work, is that needing the particular attention of personnel students, educators and psychologists. This is the crux of the unemployment problem and a satisfactory method of handling this group can be reached only by the cooperation of all the social, civic and governmental agencies in setting up a regime for developing those unfortunate persons.

MANKIND joining in a great mass movement toward self-destruction, driven blindly into a war by stern biological forces that they do not understand. That was the mental picture presented by Dr. Raymond Pearl, of the Johns Hopkins University. Studying the fruit fly, beetle and the yeast cell, among whom hundreds of generations can be observed by a single living scientist, Dr. Pearl has drawn lessons that apply to higher forms of life, including man himself. The lemming, a lower mammal,

demonstrates how blind biological forces drive creatures to multiply until great population pressures are built up and then drive them on to mass suicide. This Arctic animal has great spurts of reproductivity and, after the density has reached a certain limit, starts mass migratory movements. These great marches blindly push on until some obstacle like the sea or a river is reached. There vast hordes of the migrants still push on to their death. A parallel is found in the rapid growth of human population. In a minimum of 100,000 years up to the year 1630, man's numbers grew only to 445,000,000. Yet in the 300 years since then, the population has grown to some 2,073,000,000. For thousands upon thousands of years the human population of the earth grew slowly, because the conditions necessary to more rapid growth did not exist. Then about 300 years ago, the advancement of learning suddenly expanded man's effective universe and has kept on expanding it. There has followed a spurt of population growth of an explosiveness that is seen, when plotted to a proper time scale, to be comparable to that of an epidemic. This has produced a density of forty persons per square mile for every single square mile of the land area of the earth. That there are associated with this present density stimuli producing sensations of discomfort seem scarcely open to argument. Can it be honestly denied that, on a world-wide view, unrest is the dominant characteristic of human behavior to-day? And behavioristically viewed, unrest is surely the cardinal symptom of discomfort. Up to this point the parallelism in between the two cases seems reasonably evident. One scarcely envisages mankind marching to a watery grave just behind a horde of frantic lemmings. But does any one find it difficult to conceive of man marching off in the not too distant future to a war? Or to doubt that once well started that war will entangle in its meshes the major portion before it is finished?

NEW evidence for striking likeness in physical and chemical make-up between viruses, the submicroscopic "living molecules" that transmit diseases, and genes, the invisible somethings that abide in or on the chromosomes of cells and transmit hereditary qualities in humans, animals and plants, was produced for the consideration of biologists by Drs. J. G. Gowen and W. C. Price, of the Rockefeller Institute for Medical Research, Princeton, N. J. Drs. Gowen and Price traced this vital similarity between viruses and genes through ultra-violet and x-ray experiments on the particular virus that causes the mosaic disease of tobacco leaves. First, they took juice pressed out of the diseased leaves, known to contain the virus, and rayed that, keeping track of the rate at which the virus was killed off. But they knew that the juice contained plenty of non-virus protein molecules, that absorb the rays; it was as though they were firing at targets that were scattered among sandbags. So they purified the virus, getting it in crystalline form, and bombarded that with rays. The rate of destruction was greatly increased. Then they mixed more of the purified crystalline virus in juice pressed from undiseased leaves, and rayed the mixture. The rate of destruction of the virus became almost identical with that in the original juice from dis-

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eased leaves. Raying the virus with non-lethal doses of either ultra-violet or x-rays produces "mutations," just as raying the germ-cells of animals and plants brings forth these sudden evolutionary shifts. These mutations in the virus show themselves in the changed character of the injury they do to leaves when they are injected into the plants. In general, viruses and genes are "hit" by various kinds of rays in a rather similar fashion, and respond in ways that are suggestively alike. The inference therefore seems legitimate that in size at least, and quite possibly in other ways as well, they really are alike.

A NEW tool for use in the study of viruses was described by Dr. Ralph W. G. Wyckoff, of the Rockefeller Institute for Medical Research. It is an air-driven ultracentrifuge which whirls viruses around as milk is whirled in a cream separator, only at such high speeds that the infinitesimal virus molecules settle out. The force required for this is from tens to hundreds of thousands of times that of gravity. Dr. Wyckoff's ultracentrifuge is simple by comparison with a previous model, built in 1912 by another scientist, which was so costly to build and operate that until last year no duplicates had been made. The Wyckoff model should not cost more than three or four hundred dollars to duplicate. With the aid of this new machine investigators have the basis for a method of preparing pure virus without having recourse to chemical treatment. This opens up the way to the study of viruses which are relatively unstable or present only in small amounts. The machine can also aid in measuring the size of virus particles, in telling whether a preparation is pure and what may be the molecular weight of its impurities, and in determining whether a virus consists of one molecular species or a family of related compounds.

STUDIES of antigens undertaken in the hope of finding more effective ways of using them to protect against disease were reported by Dr. Stuart Mudd, of the University of Pennsylvania School of Medicine. The use of bacterial vaccines to protect against disease and to produce curative serums has often been limited by the toxicity of the vaccines used. If the pure substances required for immunization could be obtained free from the other toxic substances, the problem would be greatly simplified. On the other hand, the chemical methods used to obtain immunizing bacterial substances have been too drastic and have often destroyed the value of the very substances it was desired to use. Dr. Mudd described three new physical methods of disintegrating bacteria without destroying their immunizing substances. With one of these methods, Dr. Mudd and associates, Drs. E. J. Czarnetzky and Horace Pettit and Mr. David Lackman, obtained and purified the delicate immunizing substances of hemolytic streptococci. The surface immunizing substance obtained from these germs can be broken down into two fragments. One of them has been used to distinguish streptococci which cause human disease from those causing animal diseases. The other has been used to classify the human streptococci into types. The delicacy of the immunizing substances is due to the fact that they can be readily oxidized.

FUNDAMENTAL knowledge of cancer which probably is paving the way for discovery of a chemical means of controlling the disease was reported by Drs. Carl Voegtlin, J. M. Johnson, M. E. Maver and J. W. Thompson, of the National Institute of Health of the U. S. Public Health Service. Research by Dr. Voegtlin and associates has shown that, so far as the need for protein nourishment is concerned, cancer cells are just like normal cells. Cancer growth can be stunted the same as normal growth by withholding certain chemicals, the amino acids, which are the building stones for protein tissues and without which no tissue, normal or malignant, can grow. The studies reported show that the cancer cells need the same kind of materials for growth as normal cells but it is not yet known whether cancers need these materials in the same quantities that normal cells do. That now appears to be the crux of the problem. The question of distribution of chemicals throughout the body must also be considered in searching for a chemical cure for cancer. There is no reason why some chemical can not be found which would be taken up by malignant cells more than by normal cells. However, progress in understanding the chemical mechanisms which regulate the proliferation of malignant tissues depends on further progress in the study of the proliferation of normal tissues.

NORMAL, healthy tissue of the body itself may yield an effective weapon against cancer. This possibility appears from experiments reported by Dr. James B. Murphy, of the Rockefeller Institute for Medical Research, at the cancer symposium. Dr. Murphy has extracted from various kinds of body tissues a substance which checks the growth of cancers and another substance which stimulates their growth. The work is still in the laboratory stage and has not yet progressed to the development of anything like a practical means of curing cancer. But Dr. Murphy says that "The results are definite and leave no doubt that normal tissue may yield a substance apparently harmless to normal cells which prevents or retards the growth of cancer cells." From extracts of fowl tumors a substance was obtained which, when concentrated, neutralized the filterable causative agent of the tumor and prevented the growth of a type of cancer in other animals besides fowl. A similar cancer-growth-checking substance was found in several active normal tissues. Chief among these tissues are placenta, embryo, skin and pre-lactating mammary gland. Material from these tissues definitely checked the growth of transplanted cancers in laboratory animals and also checked the growth of new cancers that occurred naturally or spontaneously in such animals. In the case of one tissue, the pre-lactating mammary gland, it has been possible to separate out both an inhibiting and a stimulating factor for transplanted cancer. Dr. Murphy's studies were undertaken on the theory that cancer is the result of a break in the supposed balancing mechanism of the cell which consists of a stimulating and retarding factor. The evidence obtained from his studies can not be considered adequate support for the general hypothesis that malignancy is a break in the internal control mechanism of the cell.

A NEW theory of cancer which promises to upset many current theories was presented by Dr. Felix Bernstein, of

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New York University. The question of which persons cancer will claim for its victims seems, according to Dr. Bernstein's theory, to depend on much the same sort of factors that determine which persons will develop hay fever or other allergic diseases. As in hay fever some persons have an inherited tendency to become susceptible or hypersensitive to such factors as pollens or dust, so in cancer, Dr. Bernstein suggests, some persons have a hereditary tendency to become hypersensitive to external irritation. Hay fever, even in those who inherit the tendency to it, does not usually develop until several years after birth. Physicians believe its development depends on the extent of exposure to the irritating pollen or dust. In cancer Dr. Bernstein says the interval before the malignant condition develops in those inheriting a susceptibility to it is determined by genetic factors—factors present in the body's make-up at birth. During this interval the body is acquiring its special sensitivity to the irritating factors that lead to the development of cancer. Cancer may be a hereditary allergic disease with a genetically determined time interval of acquired hypersensitiveness to external irritation.

In another decade the words used in teaching science in elementary and high schools will be more extensive and richer than the simple vocabularies that have become pedagogically fashionable during the past few years, Dr. Otis W. Caldwell, general secretary of the American Association for the Advancement of Science and long a leader in science education, predicted to the American Science Teachers Association. Science text-books of twenty or

thirty years ago were prepared by scientific experts who did not realize the need of non-technical language in science teaching. As a result, educational experts studied the words used by children of various ages and science material for school use was written in the common and meager vocabulary of people who are not far ahead of mere literacy. Now it is necessary to rise from this low level and give the best students and teachers vocabularies which shall grow as rapidly as their new thoughts and experiences. Science instruction that will be coherent and cumulative throughout the pupil's whole school training from first grade through high school will be achieved in the next decade. And teachers will be well trained in knowledge of the science they teach—as well as in education methods upon which most emphasis has been laid in recent years.

THE guilt of causing the sudden and remarkable radio fade-outs discovered in 1935 by Dr. J. H. Dellinger, National Bureau of Standards radio chief, was fastened upon bright eruptions of the sun by research reported by Dr. R. S. Richardson, of the Mt. Wilson Observatory of the Carnegie Institution. In the past two years eighteen fade-outs of high-frequency radio transmission affecting the daylight side of the earth for a few minutes have coincided closely with bright solar eruptions observed near sunspots. But some eruptions are not followed by the fade-outs and Dr. Richardson therefore suggests that the condition of the earth's upper atmosphere, as well as the radiant energy of the sunspot, may be a factor in determining the occurrence of a fade-out.

INDEX TO ADVERTISEMENTS

Ainsworth and Sons, Inc., Wm. 27
 Ajax Electrothermic Corp. 26
 Akatos, Inc. 12
 American Forestry Association 70
 American Instrument Co. 21, 28, 33, 72, 73
 American Telephone and Telegraph Co. 4
 American Type Culture Collection 71
 Angel and Co., H. Reeve 75
 Apparatus and Specialty Co. 32
 Atlas Electric Devices Co. 39
 Bausch and Lomb Optical Co. 40
 Beck Bros. 30
 Biddle Co., James G. 14
 Biological Supply Co. 32
 Brooklyn Botanic Garden 71
 Calibron Products, Inc. 18
 Cambridge Instrument Co. 29
 Carnegie Institution of Washington 71
 Carolina Biological Supply Co. 18
 Carver, Fred S. 31
 Central Scientific Co. 8
 Chicago Apparatus Co. 15
 Clay-Adams Co. 36, 37
 Comstock Publishing Co. 49
 Connaught Laboratories 32
 Corning Glass Works 38
 Denoyer-Geppert Co. 21
 Eastman Kodak Co. 31
 Ednal Co., Inc. 73
 Edwards Brothers, Inc. 58
 Electro-Medical Laboratory, Inc. 18
 Eppley Laboratory, Inc. 27
 Evans, Adlard & Co. 71
 Farrar & Rinehart, Inc. 45

Fish-Schurman Corporation 6
 Fuess, Inc., R. 30
 Gaertner Scientific Corp. 35
 General Biological Supply House 16
 Ginn and Co. 61
 Goetz American Optical Co., C. P. 29
 Grout, A. J. 70
 Harvard University Press 69
 Heath & Co., D. C. 67
 Hoeber, Inc., Paul B. 43
 Hoke, Incorporated, 72
 Holt and Company, Henry 47
 Houghton Mifflin Co. 49
 International Equipment Co. 26
 Kewaunee Mfg. Co. 74
 LaMotte Chemical Products Co. 18
 Lea and Febiger 57
 Leitz, Inc., E. 10
 Login and Son, Inc., B. 70
 Loring, J. Alden 32
 McGraw-Hill Book Co., Inc. 62, 63
 Macmillan Co. 51, 52, 53, 54
 Marine Biological Laboratory 19
 Martini, Walter F. 29, 30, 32
 Meylan, A. R. and J. E. 32
 "M.I." 71
 Mosby Co., C. V. 55
 Muckley and Co., R. L. 32
 National Carbon Co., Inc. 28
 Nelson, George F. 5
 New York Scientific Supply Co. 33
 Oxford University Press 41
 Pfaltz and Bauer, Inc. 34
 Phipps and Bird, Inc. 22

Popper and Klein 20, 73
 Powers and Powers 72
 Purina Mills 74
 Radio Corporation of America 3
 Reinhold Publishing Corp. 59
 Rockefeller Institute for Medical Research 69
 Sargent and Co., E. H. 19
 Saunders Co., W. B. 1, 2
 Science Digest, Inc. 17
 Science Press 21, 29, 50, 56, 60, 70, 71
 Science Press Printing Co. 24, 25, 67
 Spencer Lens Co. 9
 Spindler and Sauppe, Inc. 30, 72
 Standard Scientific Supply Corp. 20, 32
 Stokes Machine Co., F. J. 7
 Stylograph Corp. 32
 Superior Tube Company 18
 Thomas Co., Arthur H. 13
 Translation and Research Bureau 70
 Troemner, Henry 73
 Truth Seeker 70
 University of Pennsylvania Press 70
 University of Toronto Press 70
 Ward's Natural Science Establishment 23
 Warren-Knight Co. 31
 Welch Manufacturing Co., W. M. 22
 Westermann Co., Inc., B. 71
 Wiley and Sons, Inc., John 64, 65, 66
 Will Corporation 11
 Williams and Wilkins Co. 68
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 Winthrop Chemical Co., Inc. 75
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SCIENCE NEWS

Science Service, Washington, D. C.

THE RADIOACTIVITY OF POTASSIUM

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A 32-YEAR-OLD mystery of atomic physics has been ended at the California Institute of Technology, according to a report to the American Physical Society. Dr. W. R. Smythe and A. Hemmendinger have succeeded in collecting, for the first time, less than a thousandth of an ounce of potassium isotope and have obtained results which may be the answer to the peculiar occurrence of helium in old minerals rich in potassium. A week of steady operation of one of the fastest isotope collectors in the world, the high intensity mass spectrograph, yielded a minute sample of the three isotopes of the element potassium, never previously separated in amounts sufficient to make possible a study of their properties.

One of those properties was the radioactivity first observed in 1905 by Sir J. J. Thomson. His discovery was made just a few years after the discovery of radioactivity in uranium and radium by the Curies. It gradually became evident that different kinds of potassium, or isotopes, existed. Potassium's atomic weight of 39.1 was finally found to be made up of a mixture of potassium with atomic weights 39 and 41 by Professor F. W. Aston in 1921. Potassium 39 naturally predominated. But still the question of whether a kind of potassium with a weight of 40 really existed, remained unanswered and there was the equally unanswered question of which of the three isotopes possessed the radioactive property. Or did all three possess certain amounts?

The present tests indicate that potassium 39, 40 and 41 do, indeed, exist. And because the samples of each one obtained are enough to study, it has been found that potassium 40—most rare of the three isotopes—alone possesses the radioactive property. The radioactivity is very weak, for about one potassium 40 atom out of a billion breaks down in a year and liberates an electron. Strangely enough, two kinds of electron activity were found in the potassium isotope which appear to make its activity different from any other spontaneous or induced radioactive disintegration. The discovery of the double shooting off of electrons may explain the occurrence of helium in old mineral containing potassium. After two electrons have been given off by a nucleus there is an excess positive charge left behind which tends to be lost by disgorging a helium nucleus. From the surrounding matter the helium nucleus picks up electrons and gaseous helium atoms are formed.

BEHAVIOR OF GIANT PROTEIN MOLECULES

THE chemical behavior and actions of those protein molecules which are one of the basic building blocks of life itself were described at the meeting of the New York Section of the American Chemical Society held at Columbia University on February 3. Professor Edwin J. Cohn, of the Harvard Medical School, in summarizing recent advances, said that during the last twenty-five

years science has learned to separate the large protein molecules by whirling them at high speeds in ultra-centrifuges, passing them through the finest filters, and gained new knowledge by studying the rates at which they pass through animal membrane. While most proteins in the body are probably spherical, many of them, especially in the tissues, seem elongated. Muscle proteins may consist of molecules that are from 1,000 to 5,000 times as long as the ordinary atoms or ions. These super-giants of the tiny world of chemistry are far larger even than the ordinary protein molecular giants, which are anywhere from 20 to 100 times as large as the common atoms.

On the same program, Dr. Johannes H. Bauer, of the International Health Division of the Rockefeller Foundation, described one of the newest ultra-centrifuges, used to separate protein molecules of different weights. Protein molecules to be studied are placed in a quartz chamber in the rotor of the device and whirled by compressed air at speeds of 60,000 revolutions a minute. At this time the centrifugal force in the experimental cell is some 260,000 times the value of gravity. Speed limit of the apparatus is fixed only by the strength of the materials from which the rotor is made; fracture of the rotor being the final happening if the speed is indefinitely increased.

Professor Vincent du Vigneaud, of the George Washington University School of Medicine, described the synthesis of such bodily-important chemicals as the cystine peptides and glutathione and thiolactone. Dr. A. A. Horvath, of the Agricultural Experiment Station, University of Delaware, reviewed research in the extraction of proteins from the soybean, a basic food of Oriental peoples. The chemistry of the soybean has major industrial significance, since soybean chemicals are now converted into plastics and as a water-proofing agent used with celluloid. In addition, soybean proteins find application as a glue and can be made water-resistant and of value for aviation veneer construction. Paper sizing and water paints are other uses.

THE PEKING MAN

THE face of Peking Man, vanished from earth nearly a million years ago, will be seen again. Discovery of a new skull of this most ancient Asiatic provides science, for the first time, with material showing the eye socket, nose bones and certain other parts of the head heretofore unknown. The skull, pronounced the most complete specimen yet unearthed, was found in the now famous cave of Choukoutien, near Peiping, China. Since the first discovery of Peking Man, no less than twenty-four individuals have been found in the cave, but always in crushed and very incomplete state. A series of discoveries within recent months has brought to light five skulls, including the latest and most enlightening example. The discoveries which offer new hope of reconstructing the features of Peking Man are being studied at Peiping Union Medical College by Professor F. Weidenreich.

An appeal has been issued to scientific workers to withhold judgment on the place in human history that this ancient Asiatic type deserves, until Professor Weidenreich can make his report. W. C. Pei, Chinese geologist, in a communication to *Nature* says that inaccurate rumors have already arisen. The last three skull discoveries are erroneously being called exactly like remains of Java Man, or Pithecanthropus, which is usually classified as the earliest of all specimens of man. Another false rumor, according to Mr. Pei, is that the discoveries show Peking Man to be identical with Neanderthal Man, an extinct form which thrived in Europe some 75,000 years ago.

SUNSPOTS AND POLICE CALLS

POLICE calls on short-wave radio are now frequently heard across the Atlantic. Two years ago they could be received only 30 to 40 miles away. The increased number of sunspots is the cause, according to Dr. L. V. Berkner, of the Carnegie Institution of Washington. The activity on the sun produces its effect by increasing the density of the electrically charged layers 65, 130 and 190 miles above the earth that reflect radio waves.

When the police radio stations were first established, the high frequency (short-wave) radio signals used penetrated these ionosphere layers and were lost in space. Now owing to the increased density of ions in the layers, they are reflected back to earth and their echoes are received at great distances.

An intensive research program of the Department of Terrestrial Magnetism of the Carnegie Institution has shown that electrical conditions in the earth's outer atmosphere vary radically not only from day to night but also with the seasons. Many vagaries of radio transmission and fluctuations in the earth's magnetism can be explained by changes in the ionosphere. There are three well-defined regions of electrification that exist in the upper atmosphere, on a typical summer day at Washington about noon. In the lowest, 65 miles aloft, called the E-region, the electrical particles or ions number about 2,800,000 per cubic inch. The F1 region, with a height of 130 miles, has 5,300,000 per cubic inch and the F2 region, 190 miles aloft, has 16,000,000. Ultra-violet light ionizes the two lower regions, while corpuscles from the sun are believed to cause the high charge on the outermost layer. During the past two years due to increased sunspots the electrical charge in the two lower layers has increased by 50 per cent. and in the upper layer 200 per cent.

GROWTH OF COLLEGE STUDENTS

COLLEGE freshmen are taller, heavier and younger than they were twenty years ago. Several years ago Harvard University discovered that its students were growing taller at the rate of one inch every thirty-two years. But, it was argued, Harvard students represent a privileged class. What about middle class Americans? The University of Cincinnati undertook to find out. Its students come from middle class homes, very few are specially privileged and many are underprivileged and entirely self-supporting. Dr. Laurence B. Chenoweth, of the Students' Health Service, assisted by workers of the

National Youth Administration, has studied the history and physical examination records of every Cincinnati freshman for the last twenty years. Men freshmen entering this university for the 1935-36 term were a full 1.78 inches taller than those entering in 1916. Freshman women entering in 1935-36 were 0.79 inch taller, on the average, than those admitted twenty years earlier. Weight has increased gradually during that period in all students, although the increase has been greater for men than for women.

In 1916 the average male student entered this university at the age of 19.45 years. In 1935-36 the average age for entering students was 18.83 for men and 18.60 for women. The probable causes of the increase in stature and weight of young people are better nutrition in infancy and childhood, less communicable disease, higher standards of living and a higher degree of health intelligence among people in general. Those who have contributed most to this improved state, in Dr. Chenoweth's opinion, are doctors (particularly pediatricians), nutritionists, public health workers and educators. These studies in the "end product of the public schools" seem to indicate that a definite racial betterment is taking place in the United States and that the improvement is only partially influenced by social and economic position.

THE STUDY OF ELECTRIC EELS IN THEIR NATIVE WATERS

WHAT happens to an electric eel when another electric eel "shocks" it? This is one of the questions being taken to the Brazilian tropics by Dr. Richard T. Cox, of the department of physics of New York University, who is leaving soon for an extended research visit in Para, Brazil, near the mouth of the Amazon, a favored haunt of the "shocking" elongate fish whose ability to generate and discharge paralyzing "jolts" of electricity is one of the classic riddles of biophysics.

Among the pieces of apparatus which Dr. Cox is taking with him is one calculated to deliver electrical discharges like those of the eel itself. His plan is to put his eel into contact with the device and then make a careful scientific record of the fish's reaction. This is something that has never been done in the aquarium studies thus far undertaken in temperate lands. Even more intimate studies of the electric eel's internal power plant and its workings are planned by Dr. Cox. He plans to block off various parts of the system of electric organs, either by sectioning nerves or with anesthetics, and thus to make analytic studies which have never been possible under aquarium conditions, where the supply of specimens is so limited that only studies of surface reactions have been possible. Dr. Cox's apparatus will include a cathode ray oscillograph, a relatively new instrument which has proved a most powerful tool in the hands of physicists and engineers in the study of the nature and rates of sudden electrical discharges. Modern apparatus of this kind has never been used in electric-eel studies. One reason why Dr. Cox is going to the tropics where the eels are, instead of having the eels brought to him, is that these peculiar fish do not survive the voyage north at all well, so that it is better economy for him to go where they

are plentiful and where it will not be necessary to keep an anxious eye on a diminishing supply in a tank.

PAPERS READ AT THE ATLANTIC CITY MEETING OF THE AMERICAN ASSOCIATION AND ASSOCIATED SOCIETIES (Continued)

A PRECISE chemical test that shows lack of anti-scurvy vitamin C in cells of the body, even in parts of the cells, was reported by Professor A. Giroud, of the Medical School of Paris, and Dr. C. P. Leblond, of the Yale University School of Medicine. A solution of acid silver nitrate, they found, makes visible even the minutest quantity of vitamin C. With this test Professor Giroud and Dr. Leblond have not only checked accurately on cells starved of this necessary vitamin, but have also traced it on its whole course through the body, from the walls of the digestive tract when it was taken in, to the kidney tubules when it was eliminated.

YOUNG plants were grown in atmospheres that might prevail on other worlds than ours, by Dr. William A. Beck, of the Institutum Divi Thomae, Cincinnati. Dr. Beck grew his seedlings under high pressures, in atmospheres of carbon dioxide, oxygen, and air, and in air at normal atmospheric pressure. He watched effects on the formation of two yellow pigments normally present in leaves. Pressure as such, he reported, did not inhibit the development of the pigments. In carbon dioxide under pressure the plants were quickly killed; in compressed oxygen they died also, but only after many hours. They thrived in compressed air, and it stimulated the development of the yellow pigments.

CELLULOSE, the wonder-material that scientific manufacture has turned into such varied products as rayon, lacquers, artificial leather, explosives and transparent wrapping sheets, has been put to equally wide uses by plants, for many ages. Before the botanists attending the meeting, Miss Florence L. Barrows, of the Boyce Thompson Institute for Plant Research, told of her search for a place in the plant kingdom where cellulose was not. She failed to find such a "cellulose vacancy." Delicate microchemical tests proved its presence in groups of plants where it had previously been said to be lacking, such as seaweed and the lower fungi. All plant cell walls that Miss Barrows investigated appear to be made of the same kind of cellulose building-blocks.

How pulse waves travel along an artery, in sickness and in health, was demonstrated with a fifty-foot "artificial artery" made of rubber tubing, by Professor Noel C. Little, of Bowdoin College. The model was constructed as a teaching aid in getting pre-medical students to understand some of the complex mechanical problems involved in human plumbing through the fact that its pipes have walls that can stretch. By modifying conditions in his fifty-foot rubber circulatory system, Professor Little gave a clear mechanical picture of how pulse-waves travel along a normal artery, and how differently they behave when the artery is stiffened by arteriosclerosis or blocked by an aneurism.

TRANSPORT planes will cruise within the next decade at 300 miles per hour instead of the present 200, thanks in part to flying at 35,000-foot altitudes in super-charged cabins. This prediction was made by T. P. Wright, Curtiss Wright Corporation engineering director. He predicted that the continent would be crossed in 12 hours and the Atlantic in 18 hours. Eight years ago two thirds of the horsepower was absolutely wasted in overcoming useless drag. This is now reduced to 25 per cent. horsepower loss. Seaplanes of much larger size were predicted for the future by Igor I. Sikorsky.

DROUGHT's approach can be detected in the soil, even before plants have begun showing signs of distress, by a new instrument demonstrated by Professor B. E. Livingston and W. L. Norem, of the Johns Hopkins University. The instrument measures the power of the soil to absorb water from a wet surface against resistance. It consists of a cone of porous porcelain buried in the soil, with a projecting tube full of mercury, against which the soil must pull, to get the water when it is poured in through a second opening. A graduated tube is attached in such a way that the rate of water absorption by the soil can be read off directly. It proved possible to tell in advance when the wilting point of plants may be expected. Professor Livingston suggested practical applications in irrigated lands and in greenhouses, so that water may be supplied when the soil actually indicates that it is needed, and not as hitherto, more or less by rule of thumb, resulting in frequent over-moistening of the soil and waste of water.

ITEMS

DISEASE-RESISTANT varieties of tobacco have been brought back to the United States from northern South America by Raymond Stadelman, who searched for them on a 10,000-mile trip through Colombia, Venezuela, Peru and Ecuador. Plants raised from the 359 samples of seeds obtained by Mr. Stadelman will be crossed with cultivated tobaccos in an effort to obtain profitable strains for the market which will also be resistant to the half-score fungi, bacteria and viruses that cause the tobacco planter his chief losses at present.

LOSSES of best farm soil during the present flood period reach almost astronomic figures, according to calculations of the U. S. Soil Conservation Service. From the Ohio watershed, where most of the rains fell, it is figured that the prolonged storm period carried away, at a very conservative estimate, three hundred million tons of topsoil. The very fact that the rain has been long drawn out, indeed, operated toward making the losses less; the same amount of precipitation concentrated in a shorter time would have washed away an even greater mass of soil. Even as it is, gullying has been exceedingly rapid. Careful measurements were made by the Soil Conservation Service of the run-off from certain fields in Ohio. From plowed land the run-off has been eight inches for the period of the rains; from comparable areas under grass and trees the run-off has been only two inches. Soil losses from the plowed land were of course several times as great as from the protected soil.

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SCIENCE NEWS

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RIVER POLLUTION BY MINE SEEPAGE

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It was estimated at the opening sessions of the American Institute of Mining and Metallurgical Engineers, held in New York on February 15, that each day the coal mines on the Ohio River's headwater pour some 20,000,000 pounds of concentrated sulphuric acid into the Ohio River. The engineers are seeking some way to prevent this great menace to down-stream cities' water supply, navigation and public health. Abandoned coal mines—the greatest potential source of the corrosive acid—affect stream pollution on a major scale. They contain much iron sulphide, or pyrite, which the layman knows best as fool's gold. The oxygen in the atmosphere combines with this mineral. Several chemical steps take place, but the final reaction production is the important one. Iron oxide, or rust, and sulphuric acid are produced. The acid seeps off in the drainage water from the mine and enters streams which ultimately form the Ohio. The Monongahela River, for example, is distinctly acid in its character because of such mine acid seepage. Only when it meets the alkaline Allegheny River at Pittsburgh is the situation improved by the partial neutralization of the acid.

E. D. Tisdale, director of the division of sanitary engineering of the West Virginia State Health Department, described how that state, through relief projects, has been employing miners to seal abandoned mines that are believed to contribute more than 50 per cent. to the pollution of the Ohio River. The idea behind such sealing is to cut off the free supply of oxygen and decrease the sulphuric acid production. Discussing the health problem raised by mine acid contamination of streams, Mr. Tisdale said: "In public health significance we observe two distinct rôles played by the acid water. It causes an acid condition in the Monongahela River for the summer and fall periods and during this time of low flows in the Ohio Basin the acid zone appears to creep farther down the Ohio with each drought spell. This makes difficult the operation of water purification plants, and when rains come, changing the river water from acid to alkaline and washing the accumulated sewage sludge in the river quickly down stream, heavy pollution loads come suddenly upon down-stream public water supplies in West Virginia and Ohio, running up the *B. coli* pollution index to a dangerously high figure. Thus the city water supplies down-stream are detrimentally affected."

Navigation suffers greatly from the acid water and especially is this true on the Monongahela, which has the highest concentration of river-borne traffic of any river in the nation. Docks, dams, locks and even vessels themselves suffer excessive deterioration. U. S. Army engineers estimate that the annual cost of navigation from this cause is greater than the entire amount so far spent in sealing abandoned mines to prevent the hazard.

STORMS ON THE SUN'S SURFACE AT TIMES OF TOTAL ECLIPSE

DR. S. A. MITCHELL, director of the Leander McCormick Observatory of the University of Virginia, reported in a lecture, given under the auspices of the Smithsonian Institution, that great storms sweep the sun's surface at the time of a total eclipse. Evidences of extreme solar activity have been obtained from photographs made during recent total eclipses, especially as shown by the coronal streamers and the lower but more intense flaming outbursts known as prominences. A comparison of all these photographs shows that the great activity of the sun was found not only at time of the eclipse but persisted throughout the whole period of four days covered by the plates. Despite the study that had been lavished on the corona, there is considerable doubt as to the real nature of the great extension of pearly light around the sun visible only during a total eclipse. That its great domes and streamers are in some way linked with the flaming prominences of the sun's body itself was suggested long ago, but the nature of the connection is still obscure. Photographs taken during one recent eclipse demonstrate the fact that the longest coronal streamers, on which the shape of the corona more or less depends, are always located near prominences but are not necessarily exactly connected with the prominences which at the time of the eclipse are of the greatest height.

If there were now living any one astronomer old enough to have started his work in 1842, when really scientific eclipse observations began, and if he had "taken in" all total eclipses since that date, with the average amount of bad luck with the weather, he would in that near-century have had only one hour's total observation-time of the totally eclipsed sun. Typical of the sun's unsolved mysteries on which data obtained with total eclipse observations provide only the merest hint, is the nature of the dark lines which appear in the spectrum of the light from the outer corona. Whether such observed dark lines really are coronal in origin or whether they are produced by the scattering of sunlight in the earth's atmosphere is still uncertain. Probably they originate in the corona, but the present evidence is not wholly conclusive.

DISCOVERY IN SOUTHERN GERMANY OF A NEW TYPE OF STONE AGE SKULL

A SKULL of an entirely new type of ancient human being, older than Neanderthal man, resembling him in some respects yet more "modern" in others, has been discovered in a gravel pit at Steinheim, near Stuttgart. It has been subjected to critical scientific examination by Dr. Fritz Berckhemer, of the Württemberger Museum of Natural History. The skull was very little broken, and lacks only the lower jaw and a few fragments of the facial bones. It resembles the Neanderthal type especially in the characteristic pronounced eyebrow ridges.

the wide nasal opening, the massive upper jaw, and the rather low cranial arch. It is markedly different in being shorter, relatively wider, and much more rounded off at the back, and in having considerably less back-slope to face and forehead. In these respects it is more like modern man, *Homo sapiens*.

The antiquity of the Steinheim skull is unquestionable. In the gravel pit with it, and extending up to a level about four feet above the location of the skull itself, were bones, teeth and tusks of an ancient species of elephant, that disappeared from Europe before the end of the Pleistocene Ice Age. From geological evidence available, Dr. Berckhemer has concluded that the new skull is two or three hundred thousand years younger than the famous Heidelberg jaw, but somewhat older than typical Neanderthal man. He does not regard Steinheim man as directly ancestral to Neanderthal man, but thinks that the resemblances between them can be explained better by regarding them both as descendants from a still unknown common ancestral stock.

INCREASED SAFETY FOR AVIATION

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INCREASED safety for aviation is seen in the newest development of the National Bureau of Standards. It is a device which enables any observer on the ground to learn the height of clouds, their thickness and the altitude to which an airplane must climb to come out above them. H. Diamond, W. S. Hinman, Jr., and F. W. Dunmore, of the Bureau's Radio Division, have cooperated in the development of the instrument. Moreover, the device can be used to learn the wind velocities above or within clouds, which conceal the upper sky, as well as to indicate the temperature and humidity of the air for altitudes up to nearly twelve miles.

The new equipment of the bureau is an improved type of radio meteorograph; a tiny balloon bearing aloft a small radio transmitter which has characteristic signals for temperature, humidity and altitude. These signals are received and recorded automatically on instruments on the ground. Previous radio meteorographs have operated the switching mechanisms by clockwork devices or by a small electric motor which needed a battery to run it. The new design operates entirely without external power and uses the power of varying barometric pressure, as the balloon rises, to accomplish the switching. The attachment to the radio balloon device which makes it possible to learn cloud thickness is a small photoelectric cell that records light brightness. As the balloon rises up to the under side of the cloud the photocell gives a reading characteristic of the light brightness found there. When the balloon enters the cloud the light brightness falls sharply and gradually increases until the upper surface of the cloud is reached and the instrument comes out into the brilliant sunshine found there. Since the light brightness for each altitude is transmitted by the balloon and received on the ground the thickness of the cloud can be accurately estimated although the cloud is miles overhead.

Moreover, by using a delicate directional antenna on the ground receiver, it is possible to follow the flight of

the balloon, even though it is hidden by clouds. This angle above the horizon and the line of direction horizontally when coupled with knowledge of the altitude at the instant when the "sight" was taken, make it possible to fix in space the position of the balloon and its radio transmitter. A short time later, when the balloon is higher, this process is repeated and the drift of the balloon due to upper air winds can be calculated easily.

The only way this knowledge can at present be obtained by balloon flights is to make two observations of the balloon from two distinct stations by the use of small telescopes. This method naturally will not work in bad weather when it is impossible for the observer actually to see the balloon. Yet this cloudy, bad weather condition is exactly the one which aviation needs most to surmount. At present much of the knowledge of upper air weather is achieved by daily airplane flights in many parts of the country specifically for this purpose. These flights are costly, however, and average, it is estimated, about \$25 apiece. The National Bureau of Standards believes that with a semi-mass production of the radio meteorographs the cost can be decreased.

THE ANNUAL CONGRESS ON MEDICAL EDUCATION OF THE AMERICAN MEDICAL ASSOCIATION

APTITUDE tests for students wishing to enter medical schools and stiffer examinations for medical students during and at the end of their course were urged at the annual congress on medical education of the American Medical Association. The tests are designed to test the student's ability to learn medicine and to forecast whether he will be a good or poor student. Results of the test must be considered together with college grades and other appraisal of the student. The aptitude test attempts to depart from the beaten paths of regular examinations, in order to determine what is left of the previous knowledge and experience of the student after most of the forgettable things have been forgotten. The test aims to measure the ability of the student to apply his knowledge remote from its usual context and thus again to distinguish what has become a part of the student from that which became part of an animated phonograph. At the same time this tests the ability of the student to face new situations on his own. It sets certain rather difficult study tasks, not requiring any previous knowledge of the subject, but testing ability to handle the sort of tasks with which the medical student is faced; and finally the whole test is a test of the ability to work under some pressure, which is so necessary in the study of medicine.

One of the speakers, Dr. Howard T. Karsner, of the Western Reserve University School of Medicine, said that the thorough examination of the medical student is a safeguard to the public. While not minimizing the importance of character and personality development, Dr. Karsner expressed doubt that these can be instilled by teaching, and asserted in no uncertain terms that the chief function of medical schools is to teach medicine. Any suggestion that the art of practice is distinct from

the science of medicine is false. Fundamental to that art and essential to it is science.

The essay type of examination, in which the medical student is asked to discuss one or two medical questions, was severely criticized by Dr. Robert P. Dobbie, of the University of Buffalo School of Medicine. Grades based on this type of examination are thoroughly unreliable and of little or no use in determining the general ability of a student. Dr. Dobbie submitted 123 such manuscripts or examination papers to four examiners for grading. The result was complete confusion. The grades given the same paper by the four competent examiners differed by from ten to fifteen points. When two of the same examiners regarded the papers five months later, the situation was more confused. Papers which had been passed the first time were failed the second, and the reverse.

BIRD MIGRATION

DR. ALEXANDER WETMORE, of the U. S. National Museum, found both eastern and western North American birds during a six-weeks' expedition to study the birds of Guatemala, from which he has just returned. In the highlands of the Central American republic, the first birds seen were from the United States, there for the winter, or in transit through the funnel-throat of Central America on their way into the wider forest of South America. Over 200 species of North American birds are known as winter migrants in Guatemala. And since Atlantic and Pacific are not very far apart in the Central American region, bird species characteristically at home in the Alleghenies there fraternize with other species that never nest east of the Rockies. Dr. Wetmore often saw in the same Guatemalan tree, birds that would never be found within a thousand miles of each other when they are at home. He also found in the pine and oak forests of the Guatemalan mountains many genera of birds close of kin to North American birds, but distinctively Central American, never straying northward. Such familiar fowl as woodpeckers, kingfishers, song sparrows, swifts, hawks and owls were found mingled with trogons, motmots and other birds not found in the temperate zone.

On one lake six specimens of helldivers, or grebe, very similar in coloration to the common helldiver of the United States and Canada, but very much larger, were collected. This lake is the only place in the world where this giant grebe is found. An oddity of bird behavior noted in one place visited was the eating of avocados by a species of black vulture, which elsewhere feeds only on a flesh diet. The avocados of that particular locality are of extra choice quality, but since they retail at only a quarter of a cent apiece the growers do not trouble to harvest their whole crop. Hence, whenever a gust of wind shakes a grove, a lot of over-ripe fruits drop to the ground and burst open with loud pops. Whereupon the waiting vultures in the treetops drop to the ground also and feast on the rich pulp.

ITEMS

New methods of examining undyed yarns developed by Professor Edward R. Schwarz, of the Massachusetts Institute of Technology, show the history of the yarn

and even its age when picked. Polarized light and microscope are the tools of the new technique which revolutionizing the art of selecting yarns for textile. Undyed yarns are nearly colorless in ordinary white light but when examined with a microscope and polarized light they exhibit various brilliant shades of color in different places. These colors are the tell-tale signs of immature fibers. In the case of cotton, particularly "unripe" fibers are weak and must be detected quickly. Even man-made rayon is not perfect and the weak spots in rayon yarns can similarly be detected by the method. Weaving the yarn into cloth does not destroy the evidence of defects and the scientific detective method not only can tell how good the yarn is, but also how well the weaving is done.

THE use of the powerful eye of the spectroscopic analyzer to analyze metals in industry, particularly in testing alloys for impurities, was explained to the symposium on metals at the Massachusetts Institute of Technology by Professor George R. Harrison, director of the laboratory of spectroscopy. Necessity of accurate analysis is emphasized by the current method of making steel which uses much scrap iron and steel reclaimed from junk yards. Usually different types of scrap are melted together and thus the resulting alloys are not always of the composition desired. Even such small amounts as one part in ten thousand of some metals, such as aluminum or molybdenum, will greatly alter the properties of steel. The inclusion of one old automobile crank case of wrong type may spoil tons of steel. The spectroscopic method constitutes a quick and accurate method of checking for such impurities. Placed on a routine basis, this method is much more rapid than ordinary chemical methods with complete analyses possible within 15 minutes, an important factor when several hundred tons of metal are being melted. Whole trainloads of ingots have been analyzed in a few hours by a clerk trained to use the instrument.

J. B. NEWSOM, mining engineer of the Idaho Marysville Mines Corporation, reported at the meetings of the American Institute of Mining and Metallurgical Engineers his success in drilling a hole 1,125 feet deep with a core five feet in diameter. The future possibilities of this method are great. When the 1,125-foot level was attained a chamber can be hollowed out and operations repeated for another 1,125 feet, and so on. From a little shack a 40 horsepower motor rotates a core barrel by means of a vertical shaft. The cutting is done at the bottom rim of the barrel by cutting teeth. As sections of rock are cut they are hoisted up the shaft. Other topics up for discussion include aerial prospecting, the transportation by air of mining equipment to distant inaccessible parts of northern Canada and Alaska; use of electrical prospecting to detect vast ore deposits now buried deeply under the earth covering piled up by the great glaciers ten thousand and more years ago; method of using supersonic, or unheard, sound waves of very high frequency to settle smoke dusts in smelters which has the interesting possibility of being also used in war time to settle enemy smoke screens and as a method of clearing up fog at airports.

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SCIENCE NEWS

Science Service, Washington, D. C.

TRANSMUTATION OF THE ELEMENTS

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INTERPRETING the transmutation of the elements, by the changing of their atomic nuclei, must be considered from the old statistical point of view of thermodynamics rather than exclusively by the newer quantum theory, according to Professor Niels Bohr, of the Institute of Theoretical Physics at Copenhagen, who addressed the meeting of the American Physical Society at Durham, N. C., on February 19. Professor Bohr believes that modern atomic theories which treat the behavior of individual atoms, particles and nuclei are bound to fail when used on heavy atoms like lead which contain over 200 protons and neutrons in the nucleus. One must revert to the well-known laws of thermodynamics which have been used for a hundred years to treat physical phenomena where a large number of particles are involved.

In barest outline Professor Bohr examines mathematically a heavy atom like lead, forgets its individual internal particles and treats it as though it were a tiny drop of water or mercury with a myriad of particles in it. Such a theoretical droplet of muscles would have such an enormous density that if it were as large as one cubic centimeter, its weight would be over 100,000,000 tons. Under normal conditions the tiny droplet may be thought of being at a fairly low temperature. During experiments in which such a nucleus is bombarded with neutrons, however, the first effect of the impact is to raise the effective temperature to the inconceivably high temperature of some 50,000,000,000 degrees Centigrade. At such temperatures the particles within the nucleus go into a state of violent thermal agitation. Some of the nuclear particles will "evaporate" and be hurled off with energies amounting to several million volts. As soon as excess energy is liberated in this fashion the nucleus will "cool" down to lower temperatures and the evaporation will cease. Any residual energy will be radiated in the form of gamma rays until the nucleus has cooled to its normal temperature. The main point of Professor Bohr's theory is the idea that a nucleus can be thought of as having a temperature and that the evaporation of particles can be treated by thermodynamics. By making detailed calculations based upon this idea Professor Bohr was able to explain a number of phenomena which have been observed to take place when atoms undergo transmutation from one kind to another. In carrying out his calculations Professor Bohr finds it necessary to use some of the ideas inherent in the more modern quantum mechanics. There is little doubt that the new Bohr theory, if proved successful, will be quickly accepted and welcomed by all physicists.

ROBERT D. POTTER

A NEW TREATMENT FOR SPODUMENE

FEW people probably ever have heard of the little-known, little-used lithium mineral called spodumene, but through a new process the mineral may soon help cool

your home, improve the dishes from which you eat, improve the production of lithia water you may drink, help to start your motor car and make a special extra tough glass. At the annual meeting of the American Institute of Mining and Metallurgical Engineers, Oliver C. Ralston and Foster Fraas, of the scientific staff of the U. S. Bureau of Mines, told of the simple method by which spodumene can be separated from other minerals with which it is associated in nature. Lack of use of the mineral has, in the past, been due to the absence of such a separating process.

Heating in a lime kiln reduces the spodumene to a chalky white mass which can be crumbled in the fingers while the remaining minerals in the ore remain strong. Even farmers and miners with home-made kilns can use the method with considerable success. The fine dust resulting from this treatment is about 80 to 90 per cent. pure, and from many localities this product will be of acceptable purity. It is much better adapted to use in making lithium chloride than the original hard, dense spodumene. It is also ready to be used in a glass batch, unless there are magnetic iron minerals in the ore, in which case a preliminary removal of iron minerals would be needed. The pottery makers have desired to use spodumene, but it has been unacceptable because of the fact that at the temperature of a lime kiln it tended to expand and tear pottery to pieces. The beta spodumene formed by the heating and now to be sifted out of the heated ore has already been expanded and does not have this disadvantage. Spodumene is the most plentiful of the lithium-bearing ores. It looks much like feldspar and behaves like it. Lithium and lithium salts, heretofore extracted from less common and more expensive ores, now promise to have several important new uses. Lithium chloride solutions, for instance, should find greatly increased use in the conditioning and drying of air in the fast-growing air-conditioning industry.

MEASUREMENT OF HEAT GENERATED BY COAL

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A NEW experimental method of determining how much heat coal will generate was announced at the New York meeting of the American Institute of Mining and Metallurgical Engineers. L. C. McCabe, of the Illinois Geological Survey, and Professor T. T. Quirke, of the University of Illinois, described a new method of coal analysis in a paper entitled, "Angle of Polarization as an Index of Coal Rank." Tiny cubes of coal are polished and brightly illuminated with a small lamp. The light reflected from the polished surface becomes polarized and is studied with Nicol prisms to determine the angle of polarization. By a fundamental rule of optics known as Brewster's Law, the angle of polarization of the reflected light can be related to the index of refraction. A final and significant step in the research was the discovery that the amount of heat in British Thermal Units

which a unit amount of coal can produce is related by a simple straight-line relationship with its index of refraction as measured in the apparatus.

Using the wide range of different kinds of coal found in Illinois from woody lignite to soft bituminous and so on to harder bituminous it was found that as the heating qualities of the coals increased, so too, did their index of refraction. The method is still in the experimental stage and the accuracy of the technique could be increased ten or one hundred times with better equipment. This investigation, however, with improvised equipment imperfect in many particulars, has discovered what appears to be a physical criterion for rank identification of coal.

WEATHER CONDITIONS IN THE UPPER AIR

AN intensive, one month investigation of weather conditions in the upper air, the first comprehensive study of its type attempted on the intricate vagaries of New England weather, has been inaugurated by Harvard University and the Massachusetts Institute of Technology. The first of a series of radio meteorographs, a combined flying weather observatory and radio broadcasting station, are being sent aloft. The aim of the project is to obtain a complete record of temperature, humidity and air pressure from the earth up into the stratosphere and thus shed more light on the forecaster's problem of how weather is "manufactured." New England was chosen for the research because of its interest to meteorologists as an unplumbed weather-breeder. Airplane flights have been conducted in New England for the past six years, and much valuable information has been gathered.

In fog or snowy weather, however, when such information is most desired, airplane ascents have been too hazardous and it was to eliminate this loophole that the radio meteorographs were developed. They also have the added advantage of easily tripling the 20,000-foot airplane ceiling and thus reaching the really important heights in weather-formation. In preliminary tests, for example, one instrument reached the amazing height of 71,000 feet, well into the stratosphere and just below man's all-time ascension record. How far the first balloon went is not known for the automatic signals of the transmitting apparatus were only followed as high as 25,000 feet. At that time a temperature of 40 degrees below zero Fahrenheit was recorded, in comparison with 24 degrees at the top of the Guggenheim Laboratory of the institute where the balloons were released.

AIR MOISTURE AND INSULATOR EFFICIENCY

LOSSES in high-tension power transmission are expected to be considerably reduced through the discovery at the Harvard Graduate School of Engineering that moisture in the air is the hitherto unsuspected cause of the costly inefficiency of the porcelain and glass insulators used on the lines. The discovery, made by Professor Chester L. Dawes and Dr. Reuben Reiter, was enabled by their perfection of a high-voltage bridge with which it is possible to detect the smallest flaws in high-voltage insulation, a problem that has troubled electrical engineers for

some time. With the instrument, an entirely new field of research in insulation is opened out which possibly may bring man closer to his dreams of managing tremendous amounts of power safely and efficiently by revealing the causes of insulator "flashovers" which so frequently paralyze power lines.

Tentative findings also indicate that one of the causes of radio interference is due to high-voltage "static" discharges over the surface of these insulators. That moisture in the air could cause such flashovers and short-circuits was unknown during the thirty years that insulators of this type have been in use until the series of delicate measurements with the Dawes bridge was made. These showed that atmospheric humidity, or moisture in the air, produces not only a pronounced power loss over the insulator, but that the loss is greater over a period of time than with a clean insulator. The greater the moisture in the air, it was found, the greater is the loss. Cleaning the insulator by vigorous rubbing with a chamois cloth, however, was found to return the power to its initial value. This led to the assumption that a permanent deposit forms on the surface of the insulator and decreases its efficiency, an assumption later confirmed by observations through a special "dark-field" microscope which readily reveals minute surface irregularities. The deposit, it was found, takes the form of millions of tiny islands which, because of difficulties of observation, are not visible with an ordinary microscope.

SCIENCE IN ADULT EDUCATION

PREDICTING that we are now entering a period of greatly increased interest in the spread of new knowledge and the fruits of recent research and discovery, Dr. F. P. Keppel, president of the Carnegie Corporation of New York, in an address given before the American Philosophical Society in Philadelphia, suggested a wide-spread effort to provide educational opportunities for adults in the field of science. He pointed out that science is a neglected field in adult education even though our civilization is "based to a degree unimaginable in the past upon the applications of science." Dr. Keppel reviewed the resources of educational and scientific America made available not alone to the children and youth in schools and universities, but to adults. He said: "Institutions must open their doors and in particular more colleges and high schools must throw open their laboratories and study collections. For use in communities where it is now available, we must have suitable science material 'on the road' just as we have our traveling exhibitions of pictures and our traveling orchestras." One liability in the proposed program is "a curious shyness on the part of our males about being caught at improving themselves culturally." Until recently adult education in the fine arts represented "what the geneticists would call a sex-linked character." One serious liability in diffusing science more adequately is the traditional attitude of so many men of science, the very men who should be leaders, not only in the advancement but in the diffusion of knowledge. "Most of those who are themselves advancing the frontiers of scientific knowledge are frankly not interested in the popular diffusion of such knowledge when approached upon the sub-

ject, are likely to reveal a fear that if it were known by their scientific colleagues that they were developing such an interest, they would lose face, and this despite excellent examples to the contrary to be found in England and elsewhere. Certain other leaders point out that the unevenness of preparation in any adult group adds enormously to the difficulties of laying any solid foundation of fact upon which a structure of worth while understanding can be erected by the individual. This liability deserves serious consideration. If it is proposed merely to carry over the classroom technique based upon uniformity of previous preparation, one can well understand the doubts and fears of these leaders. We do know, however, that excellent results are actually being obtained when instruction is individualized, and more important when the adviser has skillfully limited the student's own objective to a degree of understanding which his factual structure can safely carry. Even when the leaders in science are willing to talk to the laymen about these matters, it often develops that the two groups are not talking about the same thing. What the scientist has in mind is a broader spread throughout the American people of a belief in the importance of science and of the scientific method in modern life. Now this is admittedly more desirable. Indeed it is hardly reasonable to expect that in the long run funds will be forthcoming for the support of scientific research in adequate amount from taxation and corporate or private sources, unless there is developed a more general understanding of the objectives of science on the part of the public."

ITEMS

THE comet discovered by Dr. F. L. Whipple, of Harvard Observatory, has increased in brightness some six and one quarter times and moved a distance about six times the apparent size of the sun at noon, according to latest observations. When first noted on photographs on February 4 and again on February 7, the Whipple comet was of the twelfth magnitude. Now it has increased in brightness until it is of the tenth magnitude. It will not be visible to the naked eye until it reaches the sixth magnitude, which will require a further increase in brightness of some thirty-nine times over what it is now. Astronomers have not yet computed an orbit that will tell whether the comet will attain naked-eye visibility. Latest position of the comet is at right ascension 13 hours, 30 minutes and 5 seconds; declination plus 38 degrees, 39 minutes and 13 seconds. This position is near the minor constellation Canis Venatici, the hunting dogs. The tail of the comet is less than one degree long. For comparison, the apparent size of the full moon's diameter is a little over one half degree.

WINTER wheat in the fields seems to have escaped the hazards of winter and flood with less harm than had been anticipated, according to regular weekly summary of crop weather, compiled by the U. S. Weather Bureau. Those of the Ohio Basin show most of the wheat alive and reviving, as the water recedes. Such harm as was done was caused principally by erosion. In the upper Mississippi Valley grain region, where the fields have for

weeks been sealed over with ice, there has been less loss than observers have been fearing. In eastern Nebraska melting snow fed the crop. Snow cover still persists in the grain fields of the Pacific Northwest. Only in the dustbowl area of the nearer Southwest is the situation really unfavorable.

\$1,500,000 has been allotted by the Japan Broadcasting Corporation for television research during the coming year. A laboratory to house the experiments of Professor Takayanagi, television expert, will be completed next month. He is reported to be 90 per cent. successful in experiments to use a daylight television receiver instead of the present fluorescent-light.

CONFIRMING observations made by Dr. W. Buengerle, Dr. J. E. Davis, of the University of Chicago, has found that bits of tumor tissue, liver, abdominal muscle and lymph nodes taken from mice of the cancer or tumor strain used less oxygen than similar tissues from mice of a non-cancer strain. Along with the lower oxygen consumption of the tissues of their bodies, the cancer strain mice had larger livers, fewer red blood cells, less hemoglobin and lower red cell volume. The cancer strain mice also had more calcium in their soft tissues. Dr. Davis believes that these differences are not the result of cancer but predispose to it. These, and possibly other factors, make up the tumor disposition. He concludes that in the cancer-strain mice the presence of calcium in the tissues suffering from oxygen deficiency may have been the deciding factor as to whether a tumor would or would not result.

SCIENCE's newest aid to law enforcement comes through the ingenuity of Dr. Francis F. Lucas, of the Bell Telephone Laboratories. Dr. Lucas had noticed that on many fingerprints the fine powder commonly employed by the police technicians does not stick. He knew that a slight deposit of the body's natural oil holds the powder on a "good" fingerprint. The problem therefore was to find something to make even a slight trace of this oil material highly visible. Paper bearing suspected fingerprints is first treated with Flemming's solution, and then dipped into a dye which, under ultra-violet light, glows with a brilliant blue-green hue. The fingerprint stands out black and stark against this shining background. Its finest details can be examined under a low-power microscope, or it can be photographed up to any enlargement desired. If the paper bears print or handwriting, filter over the camera lens can cut off the ink from registering on the film, leaving only the boldly showing fingerprints.

THE invention of airplane seats that are probably more than 90 per cent. air in bulk has been patented by F. G. Manson, of Dayton, Ohio. The patent is for an airplane seat which looks like an overstuffed living room chair. However, no wood, steel or stuffings enter into its construction; only air-proof, rubberized fabrics that can be inflated. By controlling the amount of inflation the softness of the seat and also its height can be regulated.

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SCIENCE NEWS

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SYNTHETIC OCTANE FUELS

STANDARD "octane," the engine fuel sold in recent years for industrial laboratory testing purposes at twenty-five dollars a gallon, is now available, mixed with common gasoline, at moderate cost as a greatly improved "aviation gas," which scores around 100 on the octane scale of anti-knock merit.

The octane itself, sometimes erroneously labeled "iso-octane," is known more precisely as 2, 2, 4-tri-methylpentane. By a strictly synthetic chemical process it is made from isobutene, a gaseous byproduct from petroleum cracking stills, and hydrogen gas. It is probably the first single species of hydrocarbon ever synthesized for use as a motor fuel in practical service. Other gasolines are mixtures of many compounds, most or all of which occur naturally in petroleum.

Operators of aircraft are greatly interested in fuels of very high octane rating. The terrific speed required of army planes calls for engine design necessitating fuel far above the ordinary 70 to 75 level which satisfies the common automobile driver. In long overseas non-stop service, any scheme which permits a huge airplane to get off the ground with an extra five hundred pounds of cargo means great increase in revenue. Fuels of high octane number, and thus with low knocking proclivities, permit super-powered engines to deliver terrific propeller action without intolerable vibration.

Although officially rated as the 100-par value in anti-knock rating, the trimethylpentane is not the best combustible liquid in such rating. A closely allied substance, hexamethylethane, tops the trimethylpentane by a comfortable margin. Unfortunately it is much more costly to produce by methods now known. It shares with its brother fuel, however, the qualification which seems to be connected with fine motor performance. That is, in each case the atoms in the molecule are closely grouped in a compact cluster, with a diagrammatic design suggestive of a tight bunch of grapes.

GEOPHYSICAL PROSPECTING IN CANADA

At the meetings of the American Institute of Mining and Metallurgical Engineers the applications of methods of modern prospecting in Canada and the United States were discussed. In Canada, in particular, the method finds wide usefulness and its greatest development. Hans Lundberg, the Swedish engineer who has pioneered in the use of the equipment, pointed out that most of the great mineral wealth of Canada has been, in the past, discovered by geologists who prospect on the indications of surface rocks and their formation. And this, despite the fact that almost 99 per cent. of Canada's visible terrain is a layer of glacial deposits from a few feet to 120 and more thick.

It is the method of geophysical prospecting which allows science to penetrate beneath this overlying glacial drift layer and tell what the real nature of the bedrock

below may be like. Since the rich ore deposits known in Canada are found in the one per cent. of the country where they are visible it is logical to assume that there must exist valuable and rich ore bodies in the 99 per cent. of the country where they are not visible, as we know that the geological conditions must be similar. Geophysical prospecting serves to supplement the findings of a geologist in the same way that x-ray studies add to the knowledge of a surgeon. Typical of success last year were surveys made in British Columbia where, for a cost of \$6,000, deposits were found which in six weeks yielded gold ore valued at a million dollars. The same company in the previous year had spent \$60,000 in prospecting to find deposits of a similar value.

STRUCTURE OF THE EARTH'S CORE

THE earth's heavy core as a great metallic sponge filled with hydrogen gas is the latest picture of what the center of the earth is like. The Reverend Joseph Lynch, seismologist of Fordham University, advances this idea in a new hypothesis. The speed of transmission and the reflection and bending of earthquake waves are about the only ways by which science can conjecture on the nature of the core of the earth deep below the outer solid, rocky crust.

For one thing, the earth has a density averaging about 5.5, or five and a half times as heavy as water per unit volume. But the density of the crust of the earth is only 4.2, so that the core requires something—liquid, solid or gas—whose density is close to the value 12. Iron, nickel and other heavy metals have previously been suggested to explain this high density.

But a study of the way earthquake waves travel through the earth shows evidence which demands other properties besides mere heaviness. Tidal phenomena require that the rigidity of the core be appreciably less than that of the crust on whose surface man builds the cities that earthquakes occasionally destroy. In addition the core must have the property of absorbing a special type of wave motion called shear waves, for it is observed that while compressional waves easily pass through the core, there are few known cases where the shear waves come out, once they are inside.

Experiments in his laboratory show that when the metal element palladium is packed, or occluded, with hydrogen gas to several times its own volume, its properties begin to approach those comparable with what is observed in the earth. Father Lynch merely used the rare metal as a convenient experimental sponge for "holding" the hydrogen.

The findings are suggestive, however, of the metallic sponge hypothesis on the nature of the earth's core. Experiments are now under way to study the effect of the absorbed hydrogen on the elastic properties of the material. When known these properties can be correlated with those observed in the earth and additional confirmation or rejection of the hypothesis will then be possible.



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RADIO METEOROGRAPHS

RADIO meteorographs, sent aloft by balloon, have been used abroad for several years, but the foreign models are too expensive to compete with airplane reports in this country and also do not meet U. S. radio restrictions. At Blue Hill Observatory, where Dr. Charles F. Brooks is director, A. E. Bent has devised a tiny five-meter radio transmitter and Dr. Karl O. Lange a toy-like meteorograph which promises reliability at a cost which will meet airplane competition. The transmitter fits into a balsamwood case and the meteorograph, on top of it, is protected by a semi-cylindrical metal cover. The whole thing measures only $8\frac{1}{2} \times 5\frac{3}{4} \times 4$ inches, and weighs exactly one pound.

The meteorograph uses the Olland principle of rotating contacts. It is based on an upright metal cylinder hardly larger than a match, on which is an infinitesimal platinum helix. The cylinder revolves by a clock mechanism and four small horizontal silver arms touch it at four different heights. Every time the helix passes under an arm it closes an electric current which sends out a radio signal which, received and amplified at the ground station, is heard in a good loud "clump."

One of the arms is fixed and the "clumps" it sends out come "as regularly as clockwork." The three other arms move higher or lower according to tiny mechanisms measuring temperature, air pressure and humidity, and the variation in the time-interval between the "clumps" they send out is what records the conditions.

Besides coming through audibly, the radio signals are recorded on a moving plate by an ingenious arrangement of typewriter ribbon and moving pointer which results in a time base-line and three graphs analogous to the routes traced by the three fluctuating arms on the revolving cylinder of the machine aloft.

Radio meteorographs are preferable to aviator-reporters because they go higher, report quicker and are never kept grounded by bad weather. The U. S. Navy has asked the National Bureau of Standards to devise instruments of similar ability which would meet the high standards of accuracy demanded by the nautical arm of the nation's military forces.

H. Diamond, W. S. Hinman, Jr., and F. W. Dunmore, of the radio division, have developed a balloon radio device which not only tells upper air temperature and humidity for an altitude up to 12 miles, but also tells the thickness of clouds and the altitude a pilot must reach to come out "on top." Moreover, it is possible to tell wind velocities above or even inside of clouds with the apparatus.

Technically the new apparatus of the Bureau of Standards differs from previously made instruments designed for telling upper air weather in that all clockwork devices are eliminated and the switching mechanism operates from power obtained by the changing air pressure as the small balloon rises.

Cloud thickness is obtained by carrying up a photoelectric cell to measure light brightness. It is darker within a cloud and the boundary between the top of the cloud and the clear sky above is easily determined on the ground by the character of the radio signals which the radio meteorograph transmits.

A NEW TRIBE OF LIGHT-SKINNED NATIVES IN NEW GUINEA

DISCOVERY of a new tribe of light-skinned natives, in the treacherous depths of New Guinea, is stirring anthropologists to ask if roving seafarers, some primitive branch of the white race, found their way to New Guinea in the South Pacific, there to lose themselves in the heart of an island jungle? That this did happen long ago, giving pale-face ancestry to a tribe that now numbers some 50,000 people, is the conviction of Jack Hides, discoverer of the tribe. Mr. Hides is a resident magistrate of New Guinea. His discovery has awakened much interest among anthropologists. It suggests that New Guinea was settled by both whites and blacks—some branch of the Indo-European race, as well as the negroid people from Asia.

Mr. Hides gave the following description of these unknown people to Science Service:

"These people were short in stature. They were light-skinned, something similar to the Malays. They had large mops of brown-tinged hair, high cheek bones, and yet rather good features. They were bow and arrow people and made beautiful axes of stone. They call themselves the Tarifuroro.

"Their methods of agriculture were the best I had ever seen. Their terraced gardens of an unusual squareness, marked off by pretty hedges of croton and hibiscus, were not unlike the Chinese market gardens we see in Australia. They grow sugar cane, ginger, bananas, sweet potatoes, spinach, mimica and native asparagus. There were no taro or yams. They often brought us pretty baskets of brown salt, which they obtained by burning logs of certain wood.

"I believe that further to the westward of these people in the adjoining valley, which is even larger than the Tarifuroro, we will find an even larger population and a more clearly defined Asiatic type. My reason for stating this is, as I traveled eastward across the Tari and Purari tableland, I found the light-skinned people merging into the darker-skinned Papuans, until just before I crossed the limestone barrier again, I found the real black Papuan men using the same methods of agriculture as the light-skinned Tarifuroro. It rather suggested to me that, at one time, these light-skinned people inhabited the whole of this tableland and were driven back westwards by the more virile Papuans."

Mr. Hides found the light-skinned tribe when he made an exploring journey, accompanied by a patrol officer, nine native policemen and 28 native carriers. Traveling up the Strickland River in a schooner, and thence up an unknown river to its source in dugout canoes, the party then climbed a difficult limestone barrier and found themselves on a high plateau inhabited by unknown thousands of New Guineans.

Matthew W. Stirling, chief of the Bureau of American Ethnology, says that there is an anthropological theory that an early wave of white migration swept across southern Asia to the Pacific. It is not impossible, if this be true, that traces of it might be discovered in the East Indies. Such an explanation has been offered for the Ainu of Japan and for the Polynesians. It is his opinion, however, that Mr. Hides probably encountered a new

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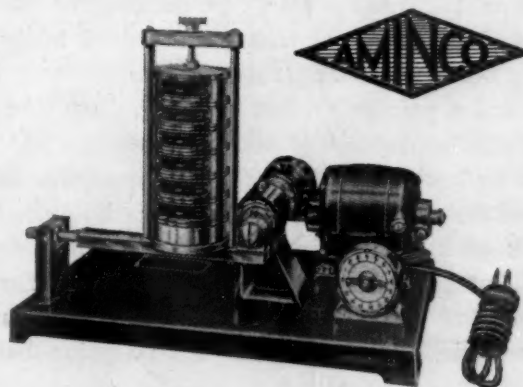
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branch of the short-statured, light-skinned mountain peoples of the interior of New Guinea and passed from these to eastward toward the decidedly black-skinned Melanesians and was impressed by the contrast in skin color.

THOMAS NUTTALL

WIDE-RANGING travels of an early American naturalist, Thomas Nuttall, who wandered and collected specimens all over the United States when most of the country was still "Wild West," have been traced by Dr. Francis W. Pennell, curator of botany at the Academy of Natural Sciences of Philadelphia. Although the most traveled of our early naturalists, and especially famous for his work in botany, the whole course of Nuttall's journeys has never before been traced. Sources of information include works of other early travelers, incidental contemporary notices, records of plants and birds scattered through Nuttall's own works, and a remarkable discovery of old letters and manuscripts recently made by Mrs. John R. Delafield at "Montgomery Place" in Dutchess County, New York.

For one who did all his traveling between the years 1807 and 1836, Thomas Nuttall covered an astonishing territory. He traveled extensively through the more settled parts of the United States, down the Ohio, through the southern Appalachians, through the Great Lakes to the Wisconsin River, down the Mississippi and up the Arkansas River to the present Oklahoma, up the Missouri only a few years after Lewis and Clark, and later by the Oregon Trail across the continent to the mouth of the Columbia River, thence across the Pacific to Hawaii and back again to California. He collected thousands of plants, was responsible for the naming of scores of species, and by gathering seeds introduced many native American flowers into cultivation. Nuttall was English by birth and a printer by first training. He was remembered by a fellow-printer of his youth as one who "always was reading books." His technical knowledge of printing helped toward the publication of his books. In 1841 the death of a brother in England left him heir to an estate, but under terms that made it necessary for him to leave America. Except for one six-months' working visit, he never again saw the land of his adoption before his death in 1859.

STERILIZING LAMPS

THE day when man will fight and conquer micro-organisms of disease and decay with the sun's rays or their laboratory-made equivalent seems to be drawing near. Steps already taken in this direction were described by A. R. Dennington, of the Westinghouse Lamp Company, at the Toronto meeting of the Canadian Section of the American Institute of Electrical Engineers. Sunlight can kill micro-organisms even when its ultra-violet and infra-red rays are filtered out. The rays of shorter wave-lengths, from 2,537 Angstroms down, are the most effective germ-killers. Such rays harnessed in a lamp which has an extremely thin indrawn window or glass bubble are already being used by physicians to destroy the germs of skin infections. At the opposite extreme are the eight sterilizing lamps installed

over the operating table at Duke University Hospital to sterilize air during surgical operations and thus prevent wound infections.

For keeping meat safe by preventing mold growth during the tenderizing storage period, and for keeping mold out of bakery products, there is the tubular lamp made of special glass and resembling the blue neon sign tube. Other lamps that give off sterilizing rays are being investigated in the hope of developing a ray method of sterilizing milk. The ultimate hope of investigators in this field is to find ways and means of purifying the air to offset the danger of breathing in germs that are constantly being breathed out into the air.

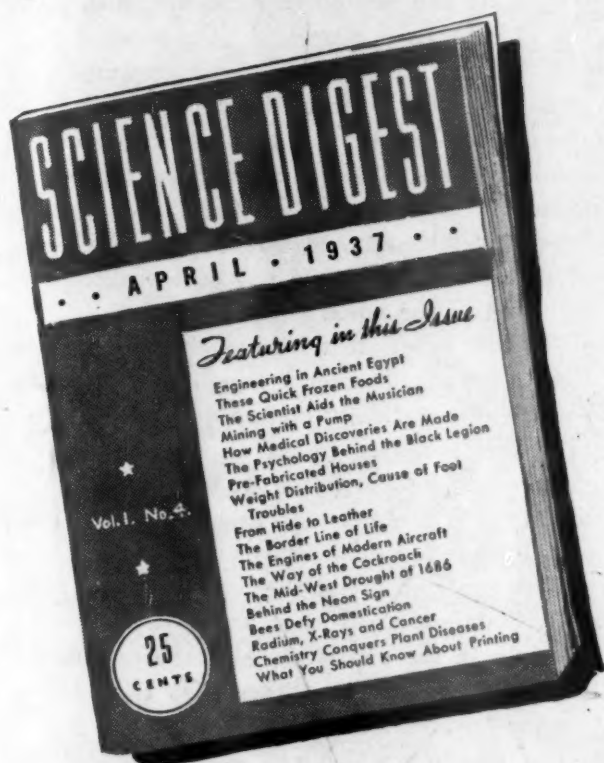
ITEMS

A SEVERE earthquake shook the ocean bottom near the northern end of the Japanese archipelago on February 20, at 2:03 A. M., eastern standard time. It was followed by two sharp aftershocks. The epicenter was in latitude 45 degrees north, longitude 148 degrees east. A strong earthquake was felt at College, Alaska, on Wednesday, February 24. Records on the instruments of the seismological observatory maintained in cooperation with the U. S. Coast and Geodetic Survey indicate that the epicenter was not far away, and somewhere on a line extending through College in a general northeast-southwest direction.

FLOODS in most places are caused by waters from the skies. Floods in Iceland have been caused by fires under the earth. Investigations by Dr. Niels Nielsen, of Copenhagen, show that two recent destructive floods in Iceland were caused by the eruption of volcanic vents opening under thick glaciers. The heat melted the ice rapidly and in such vast quantity that the total water volume of the larger of the two floods is estimated at over a billion cubic yards. Molten lava coming into contact with the ice was hardened into curious globular rocks. It had previously been suggested that similar subglacial eruptions might account for globular rocks forming some of the highest mountains in Iceland, whose formation dates from early Ice Age time. Dr. Nielsen's observations, published in *Nature*, are regarded as confirmation of this hypothesis.

ADOBE bricks from ruins of a Dominican Mission in Lower California have preserved evidence of a smallpox epidemic that ravaged the Indian population in 1781. Two California scientists, Professor G. W. Hendry, of the University of California, and M. K. Bellue, of the State Department of Agriculture, who have been examining bricks from old missions, made the discovery of bones in bricks from San Vicente Mission. It is supposed that builders of the mission must have shoveled in bone fragments from unmarked graves of smallpox victims when they were getting earth to make the brick. Mission bricks are yielding many clues to early western history. On some bricks are footprints of men, dogs, coyotes, birds; and in other bricks have been found nut shells, leather trimmings, pottery, copper fragments and seed of plants grown in early days in the West.

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SCIENCE NEWS

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CONCENTRATION OF NEUTRON BEAMS

PRELIMINARY tests indicating that neutron beams can be concentrated by use of paraffin lenses reported in the current issue of *The Physical Review* by Professor Gilbert N. Lewis, of the University of California, in collaboration with Philip W. Schutz, will be, if confirmed, of great significance to physical, chemical and medical radiation research. The importance of the announcement lies in the fact that neutrons are the latest and in many ways the most effective "bullets" with which the nuclear cores of atoms can be probed and in which new knowledge of this hidden physical world can be obtained. Moreover, it has recently been found that neutrons are much more efficient in creating ionization in living tissues than are x-rays or gamma rays from radium. Thus the possibility of using neutron beams for treating cancer has been a motive behind much of the recent research. If Professor Lewis's findings, that the use of a paraffin lens will gather and collect neutrons and can increase the concentration of these non-electrical particles in a beam, turns out to be correct, then laboratories throughout the world will take up the technique.

More and more potent beams of neutrons are being sought in all laboratories. Either "howitzers" of paraffin are used which contain a mixture of beryllium and radium, or else giant accelerating apparatus like the cyclotron is employed for creating neutrons. The high price of radium is a handicap in pursuing neutron research. The large accelerating apparatus, too, is costly. Concentrating neutron beams with lenses of paraffin thus would be a major aid to research, for weak sources could be used with an effectiveness now attainable only in a few favored laboratories.

The evidence reported by Professor Lewis and Mr. Schutz indicates that neutrons are bent, or refracted, as they pass through paraffin. Professor Lewis points out that although neutrons are considered to be of a particle or corpuscular nature the new finding can not be interpreted by present theory. He says: "We have been unable to conceive of any purely corpuscular explanation of this remarkable phenomenon." If it is assumed, however, that each neutron is accompanied by a train of waves an interpretation consistent with the facts appears possible which is closely akin to the phenomenon of refracting, or bending by the passage through the paraffin.

A NEW METHOD OF SMOKE-PARTICLE PRECIPITATION

THE U. S. Bureau of Mines recently demonstrated a method of ridding chimneys of dust and smoke particles by the use of sound waves. The development, because of its cheapness, strikes at one of the most potent sources of industrial smoke—the small factory.

Developed by H. W. St. Clair, from the laboratories in Minneapolis, Minn., the precipitation of chimney smoke by sound truly works a seeming miracle. In his recent demonstration Mr. St. Clair filled a five-inch diameter glass tube with thick white smoke. Then he turned into

the tube the sound waves of a high pitched note of 7,000 vibrations a second. And at once the smoke particles began to cluster in striated levels down the length of the tube and wandered off to the walls and fell to the bottom.

The idea behind the method, for which patents have been applied (to be turned over free for the benefit of the public), is the simple experiment which every one who has ever taken a course in physics must have performed. In that experiment, standing waves of sound were generated that bounced back and forth in a tube from one end to the other and created regions where there was a maximum amplitude of sound wave vibration called anti-nodes and then, alternately, regions where there was a minimum of vibration, called nodes. The experiment showed that dust was kicked out of the anti-node areas and deposited in the nodal region.

The St. Clair experiment with smoke precipitation uses this long known phenomena except that the standing sound waves run vertically up and down the smoke stack, instead of horizontally. In actual practice the smoke and flue gases would be run in at the bottom on the side of the chimney and come out at the top, also on the side. And all the while the sound waves bounce up and down in the stack to precipitate out the particles.

Mr. St. Clair's method of smoke particle precipitation is completely in the experimental stage in America, but small pilot plant operations have been tried out in Germany in the past year or two.

The first question which any one acquainted with the field of smoke stack flue particle recovery is, "How does it compare in effectiveness with the Cottrell electric method and also in cost of installation and maintenance?"

The answer to this question on the relative merits of the Cottrell and St. Clair methods is that one has to know something about the cheapness of a real installation and not merely a laboratory, demonstration model. It seems as if the St. Clair method might be cheaper but no one yet really knows.

PLANT NUTRITION

SOME plants, like some children, have finicky appetites. Professor Lyman G. Schermerhorn, of the New Jersey Agricultural Experiment Station, blames just such a cause for hitherto unexplainable failures of certain vegetable varieties to produce their best crops under orthodox cultural methods. Nutritional requirements of plants are just as various as those of animals, he observes in reporting that plant feeding experiments undertaken a year ago have already supplied many clues to solve the mystery of reduced yields. Each variety of a vegetable group requires different feeding, and we'll have to learn how to feed them as varieties, catering to their whims regarding fertilizer performances and the exact time when a given variety of plant seems to want and need nutrition.

For example, he makes clear that plant feeding tests have already determined that large applications of nitrogen to different varieties of lima beans did not perceptibly increase the yields of the small varieties, but

greatly increased the production of large-seeded limas. Tried on tomatoes, one popular variety was found to respond best to heavy doses of fertilizer early in the season, while another variety produced best only when fertilized after its fruit started to set. Growers have always used both varieties alike.

Professor Schermerhorn predicted that "after the farmer learns to recognize that he can't feed all vegetable varieties alike, a great deal of confusion that now exists in the seed trade will be eliminated because the number of varieties will have to be reduced." Improper plant feeding may even be so far-reaching as to cause the germination disorders in beans and other seeds which perplex both farmers and seedsmen. Plants which are vigorous and healthy as the result of proper nutrition are more resistant to disease and frost.

COLORED LIGHT AND FOOD MANUFACTURE IN PLANTS

RED light doesn't mean "stop" to plants in the food-manufacturing business; it means "go ahead." Green light comes nearer to signifying "stop" to such plants. Blue is another "go-ahead" light. These facts were developed in a research project by W. H. Hoover, of the Smithsonian Institution. He placed young wheat plants in a glass vessel, through which air could flow at a controlled rate. He passed the light received by the plants through filters that took out all but certain chosen wavelengths, all maintained at the same level of energy-intensity.

The ingoing amount of carbon dioxide, out of which green plants manufacture primary foods, was definitely known. Analysis of the outgoing air showed how much of it had been removed by the plant in the food-manufacturing process. The less carbon dioxide coming out while a given color of light was on, the more efficient that light as an energy source for the plant's work. Most efficient of all wave-lengths tested was found to be in the red, close to the border of orange, at a wave-length of 6,550 Angstrom units. Low efficiency was reached at about 5,500 Angstroms, in the green. A second peak of efficiency came in the light blue end of the spectrum, at a wave-length of 4,400 Angstroms. Dull red light at less than 7,500 Angstroms was of no use to the plants in Mr. Hoover's experiments, but they could still manufacture at least a little food under the invisible radiation in the lower ultra-violet region, up to about 3,650 Angstroms. The limit of visible violet light is about 3,900 Angstroms.

PRONTOSIL AND PRONTYLIN IN THE TREATMENT OF PNEUMONIA

A NEW victory in the fight against pneumonia has been reported by Dr. Ralph R. Mellon, director of the Western Pennsylvania Hospital Institute of Pathology, Pittsburgh. Prontosil and its close relative, Prontylin, chemical compounds already used in cases of deadly streptococcus infections, are proving effective remedies for Type III pneumonia. Serum treatment has not been satisfactory in this pneumonia although Types I and II pneumonias can be cured by use of the proper serum. Reports of patients treated with these chemicals were given

by Dr. Mellon before an audience at the University of California and at the meeting in Pasadena of the western branch of the Society of American Bacteriologists.

Of 9 Type III pneumonia patients treated with the chemicals, 7 recovered and 2 died. These figures are exactly the reverse of those for a group of 9 patients who were not given the chemical treatment. In this group, 7 died and only 2 recovered. The number of patients treated is not large, but studies of the chemical treatment for pneumonia in mice and rats adds to the evidence for the value of the new remedy. These studies have been going on at a number of institutions since the value of Prontosil for streptococcus infection, such as childbed fever, septic sore throat, scarlet fever and erysipelas, was first announced.

Dr. Mellon and associates studied the effect of Prontosil and Prontylin on pneumonia in rats rather than mice because pneumonia in rats is more like the human disease. In a group of 14 rats infected with Type III pneumonia, the deathrate was 85 per cent. These rats had not had any prontosil treatment. In another group of 13 rats with Type III pneumonia, Prontosil treatment brought the deathrate down to 23 per cent. Chemical treatment of pneumonia is not new. Many years ago, Dr. Lloyd Felton, of the Harvard Medical School, studied the action of various chemicals, including sulfanilamide, the active part of Prontosil, in pneumonia. When a successful serum treatment for Type I pneumonia was developed, however, the idea of chemical treatment of the pneumonias was abandoned. Investigators have since been trying to develop equally successful serums for all the 32 pneumonias, especially the first four types. Successful serums for Type I and Type II are now available.

BACTERIA, MOLDS AND YEASTS IN THE SOLUTION OF FARM PROBLEMS

BACTERIA, molds and yeasts, more noted now as disease-bringers and spoilers of things than for their useful activities, were considered as potential factors in the solution of America's agricultural problems by Professor Ellis I. Fulmer, of the Iowa State College, in an address made, on March 10, before the Midwestern Conference of Agriculture, Industry and Science, at Omaha. Farming is essentially a chemical manufacturing process. The farmer is foreman in a chemical factory, wherein his crop plants are living machines using the energy of sunlight to make carbohydrates, fats and proteins out of raw materials from air and earth. In the process, energy is woven into the things that come out as end-products.

Formerly the farmer used the release of a large part of that stored energy by feeding crop products to his work animals. Now he uses tractors and power machinery instead of horses and mules. So the products pile up, creating economic crises which can be only temporarily solved by crop limitation methods. A considerable part of the answer can be found in turning over the job of digesting carbohydrates to bacteria, molds and yeasts. These use up part of the energy in their life processes, but they turn back to the chemical industrialist a great variety of liquid fuels, solvents, ingredients for explosives, etc. Professor Fulmer displayed a list of

more than forty products that can be obtained from the microorganic fermentation of carbohydrates, only a few of which have present economic uses.

Dr. Norman F. Kennedy, of the Corn Industries Research Foundation, told the conference of a number of less familiar but very important uses of the two principal industrial products of corn, starch and syrup. Starch is used in enormous quantities in the manufacture of textiles, long before they are cut and sewed into shirts or sheets. It plays an important rôle in the production of paper, twine, burlap bagging, and many kinds of adhesives. Syrup from corn also has its uses in the textile and paper industries, and in such diverse industries as tobacco manufacturing and the tanning of leather.

NEANDERTHAL REFUGE

WISENT, wild horses, reindeer and other game animals that Neanderthal Man hunted for food are now at home in a special game preserve in the famous Neanderthal, the valley of the little river Neander where the bones of the beetle-browed race were first found in 1856. Dr. Richard Rein, of Dusseldorf, who has long agitated the project, had the satisfaction recently of seeing the first wisent released in the enclosed area.

The animals now in the preserve include several wisent, or European bison, herds of fallow deer, red deer and reindeer, and a small herd of wild horses. The latter animals, similar in size and shape and color to the wild horses pictured on cave walls in France and Spain, are from the herd kept by the Duke of Croy-Dulmen, in Westphalia. It is proposed also to introduce moose, chamois and ibex, all of which were included in the meat menu of cavemen. No artificial shelter is provided, but the animals appear to thrive perfectly well in all weathers, taking advantage of natural shelter in the woods.

Of special interest is the effort to increase the number of wisent. Pure-blooded animals of this species now number less than 100 head in all Europe, and efforts are being made to increase the stock by breeding. At the same time a type of cross-breeding known as "Verdrangungszucht," or elimination breeding, is being carried on with American bison cows. A wisent bull is bred to the bison cow. Only female calves are saved. These hybrids are again bred back to pure-bred wisent bulls. Thus each generation will have less bison and more wisent blood, and in the end the animals will be practically pure-blood wisent. This method, in use elsewhere in Germany, is also being followed at the Neanderthal preserve.

ITEMS

THREE months were required to construct and install the telephone system of the new Department of Interior building in Washington. An additional month was needed to perfect plans for the cutover from the old system, and only 80 seconds were needed for the actual transfer. The switchboard is so large that 3,700 calls can be handled at once.

PALEONTOLOGISTS of the Smithsonian Institution have identified as belonging to camels some of the bones found by a Smithsonian expedition at the only known dwelling

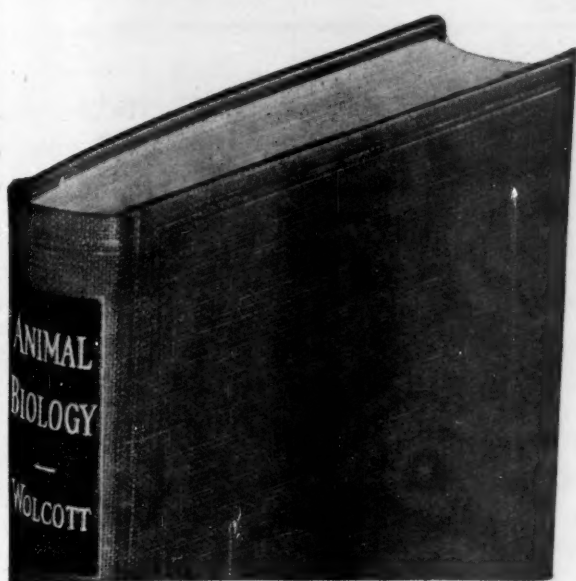
site of Folsom Man, in northern Colorado. Importance of the camel bones is that the camel survived the Ice Age in North America only for a short time, if at all. That Folsom hunters ate camel, therefore, is good evidence that human beings had already arrived near the end of the Ice Age—a point much debated among America's prehistorians.

GALLSTONES apparently can form and survive only by "staying on the alkaline side," it appears from the report of researches by Dr. Maurice Feldman and associates of the University of Maryland School of Medicine. They implanted human gallstones in the gallbladders of dogs. The stones dissolved, apparently because dog bile is more acid than that found in the human gallbladder. Gallstones similarly implanted in guinea-pigs, which have alkaline bile, failed to dissolve.

VACCINATION against influenza has succeeded in actual practice. A group of men and boys at New Jersey State Colony were protected against this disease during an epidemic by vaccination with active human influenza virus. Drs. Joseph Stokes, Jr., Alice D. Chenoweth, Arthur D. Waltz, Ralph G. Gladen and Dorothy Shaw, of the University of Pennsylvania and Children's Hospital, Philadelphia, report that the vaccine was given at the outbreak of the influenza epidemic in and around Philadelphia in February and March last year. In the vaccinated group of 110 men and boys, 3 had typical influenza with fever. In an unvaccinated group of 550 at the same institution, 12.5 per cent. developed influenza with fever. Scientific details of the vaccinations and interpretation of the results appear in the current issue of *The Journal of Clinical Investigation*.

DENMARK has begun to vaccinate all its children against whooping cough, hoping to add this disease to smallpox and diphtheria as ills from which little children need not die. This news was brought to America by Dr. Thorvald Madsen, director of the Serum Institute, Copenhagen, and president of the Health Section of the League of Nations. Whooping cough is the most serious disease of children in Denmark. It ranks ahead of diphtheria and scarlet fever. In a group of 1,000 unvaccinated children this disease killed twenty-six. In a group of 3,000 vaccinated, there were only six deaths. Such figures have convinced health authorities of the desirability of vaccination. The vaccine will be given as early as possible in cases of whooping cough which may develop. It has been found to lessen the severity and shorten the course of the disease.

A COMPLETE fossil specimen of a long-spined Dimetrodon, one of the earliest reptiles and apparently the commonest animal on earth about 225 million years ago, has recently been brought to Harvard University by Robert Witter, of the Museum of Comparative Zoology. It was found in the "red beds" of northwestern Texas, which have previously yielded numerous skeletons of the early Permian period, of which the Dimetrodon was characteristic. This flesh-eating creature had its day and ceased to be, long before the rise of the Kingdom of the Dinosaurs.



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SCIENCE NEWS

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THE ABSORPTION OF SCIENTIFIC DEVELOPMENTS BY SOCIETY

DISSATISFACTION with the manner with which society has met and absorbed scientific changes was expressed in a series of four lectures at Princeton by Dr. Frank Baldwin Jewett, president of the Bell Telephone Laboratories. Speaking on "An Engineer Looks at the Social Implications of Science," he said of the government, "the political government, since it must of necessity be organized to do a vast number of things, is less likely to be competent in a highly technical matter such as the development and application than is a private organization designed and operated solely for that scientific purpose."

Although the government can not directly use the services of engineers and scientists because their field is one in which they can operate with entire absence of certain factors normally present and controlling in other human affairs, still the government should make more use of the knowledge of these men.

Speaking from an international view-point, Dr. Jewett asked, "how will the world of those who wish to retain what they have protect themselves against the degrading effects of those who, equipped with the same tools, are struggling to elevate their standards?" "One has only to visit the more recent of the vast technical establishments of the Orient, particularly those of Japan, to be acutely conscious of how far the migration of applied science has carried the world since the days of its beginning, and how pregnant with social and political problems the future is."

To meet these problems, he recommended the inclusion of science training in the education of every student, "with the thought that thereby they and the society they are to form will be better equipped to handle the problems of science and particularly the problems created by science."

He made "a complete refutation of any claim that applied science has reduced gainful employment," and citing the automobile industry, which threw out of work many drivers, hostlers, wagonbuilders and farm laborers, he pointed to the mushroom growth of allied industries of the automobile that have in the end increased the total of employed labor. One evil of science Dr. Jewett showed to be that "frequently the appeal of some new thing is such as to offer a lush field for the get-rich-quick artists or those who pander to the baser sides of human nature." He added that such exploiters must be safeguarded against, for "we no longer have opportunity to become fully acquainted with a new thing before its mass impact has confronted us with a major problem of social control and legal regulation for which we have no established guides."

INTERNATIONAL SYMPOSIUM ON EARLY MAN

In a Hall of Man with walls and ceiling gaily modern in red, blue and white design, valuable drab relics of bone

and stone representing man's start on earth are being studied in Philadelphia at an International Symposium on Early Man. The symposium, which is drawing famous scholars of prehistory from far corners of the world, is being held in celebration of the 125th anniversary of one of America's oldest scientific institutions—the Academy of Natural Sciences of Philadelphia.

A skull of Minnesota Man, which Professor A. E. Jenks, of the University of Minnesota, pronounces 20,000 years old, was one exhibit arousing keen interest. If fellow scientists agree with Professor Jenks on the antiquity of this skeleton from a lake bed, then Minnesota Man may become accepted as America's oldest inhabitant—unless some new discovery turns up to carry our prehistory farther back.

A long, slender dart point of bone found resting on the ankle of a prehistoric elephant in New Mexico, is another important clue to America's first people. This hunting exhibit, unearthed by Edgar B. Howard, secretary of the symposium, is considered good evidence that human beings had already arrived in the New World before the last mammoth and other Ice Age animals had all perished. The date of the elephant hunt is set by Mr. Howard at no later than 10,000 years ago.

Ten or twenty thousand years ago is only yesterday in human history. But America has no relics to compete in age with the Old World's revelations on man's beginnings. The struggle of man to establish himself there is told in parts of skeletons—showing brutish jaws or chinless ones, heads ape-like in their flatness or thrust forward at awkward angles, and many another trait that has fortunately, as we think, become obsolete. So valuable and irreplaceable are the scraps of those vanished human types, that many of the foreign members of the conference are bringing with them plaster casts of famous specimens. Latest discoveries in the caves where Peking Man had his home, over half a million years ago, are among those duplicated by casts. They have been brought from China by Père Teilhard de Chardin, Jesuit priest and anthropologist.

At the opening session, Theodore McCown, in presenting a paper by Sir Arthur Keith and himself, introduced Palestine Man, who must have lived at least 60,000 years ago.

For the first time—*Homo sapiens*—the species to which all modern men belong—is discovered existing as far back as the middle of the Old Stone Age. Two types of man lived in the Palestine caves, and both lived about the same time. The caves which have yielded their skeletons are at Mount Carmel. British and American archeologists have been working jointly to salvage the important chapter of prehistory buried there. Of the two types of Palestine Man extracted from their hardened earth beds, one type was small and had many traits like the clumsy, chinless, low-browed Neanderthal men of western Europe. The other type was tall, even approaching six feet, and these men had faces much nearer our own modern type.

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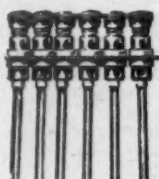
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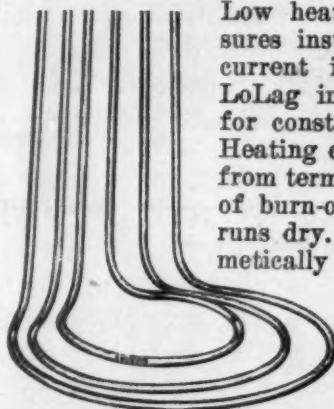
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The fact about these latter people that is surprising is that they varied widely among themselves in type, in what was described as "their evolutionary plasticity." They are a variety of man who may be considered as the prototype of the earliest modern Europeans.

Carrying the history of mankind back into a much earlier chapter, long before *Homo sapiens*, W. C. Pei, of the Institute of Human Paleontology in Paris, reported the discovery in China of extremely ancient stone tools. One piece of worked stone and some worked bones are believed to be the oldest indications of human handwork in China. These tools seem to be even older than Peking Man, who is credited with beginning the true Stone Age industry in China. Peking Man, China's oldest known inhabitant, has been given an estimated age of half a million years. The new discovery of stone tools goes back to the Pliocene period of geologic time, when man and his work are still almost completely mysterious.—EMILY C. DAVIS.

THE DISAPPEARANCE OF GOITER IN THE MIDDLE WEST

NOBODY disputed Dr. David Marine when he said twenty years ago that a normal thyroid gland could be found only along the seacoast. Michigan and Ohio can successfully refute any one who makes that statement to-day.

There is Midland County, Michigan, where, in 1924, one third of all the school children showed a well-developed goiter and where a questionable enlargement of the thyroid was seen in almost every child. Now in Midland County anatomically normal thyroids are found in 90 per cent. of the children. They have been taking iodized salt to make up for the deficiency in food iodine in that locality. In this same county live five families whose doctor warned them against iodized salt, saying the children would develop acne. These families followed their doctor's advice for from three to six years. When the goiter committee from the state health department made a state-wide survey recently, it was especially interested in these families. The children did not have acne—it is true—but eight of them had moderately enlarged, soft, spongy hyperplastic goiters. Recently the committee examined 3,000 children who had been using iodized salt regularly for years. Less than 2 per cent. of them had goiter. Nor did the committee find more cases of acne than would be expected.

Dr. O. P. Kimball, of Cleveland, who describes in the forthcoming issue of the *Journal* of the American Medical Association the program of goiter prevention in Michigan and Ohio, tells of an interesting contrast in two Michigan cities. In Houghton County are Houghton and Calumet, towns thirty miles apart. Calumet is a mining town and during 1932 the copper mines closed. Many families were on relief and only bag salt (not iodized) was given to relief families. While in Houghton the percentage of goiter cases remained low, in Calumet without the iodized salt, which was the only source of food iodine in half the homes for three years, endemic goiter became proportionately as prevalent as it was before prevention was initiated.

In Detroit the incidence of goiter dropped from 35 per cent. in 1924, when the goiter prevention program was begun, to 5 per cent. in 1936. However, in Cleveland the drop was from 31 per cent. to only 18.5 per cent. The city health department investigated and found that two local salt manufacturers were labeling their various brands of salt "iodized" when containing only one third of the amount of iodine stated on the label and one brand sold by a large chain store contained no iodine at all. In each study made in various other cities, the iodine content of nationally advertised brands and the trade brands prepared by these manufacturers for other companies was found to approach closely the amount advertised.

ECONOMIC VALUE OF HIGHER OCTANE AVIATION FUELS

How the commercial airlines potentially could save over \$1,000 per trans-continental trip from New York to Los Angeles was described at the National Aeronautics Meeting sponsored by the Society of Automotive Engineers in Washington. This is equivalent to carrying about seven extra passengers per trip at present one-way fare rates.

D. P. Barnard, of the Standard Oil Company of Indiana, suggested the use of super 100 octane anti-knock gasolines to achieve the theoretical economy. He showed in a study of the values of octane number improvements in aviation gasolines in terms of increased earning power of the current type transport planes, that each increase of one single unit in the octane rating of aviation fuels is worth up to five cents a gallon of gasoline, when proper provisions have been made in the original designs.

On a trans-continental flight from Newark to Los Angeles, with an airline distance of 2,524 miles, the benefit would be about \$68 for the increase of a single number in the octane rating. Theoretically, at least, a jump from the present 87 octane fuels to the 100 octane gasolines would thus yield a potential saving of \$1,064 for each trans-continental flight. With a fare of approximately \$140, one way, this is essentially the equivalent of carrying over seven extra passengers per flight. The economic value of using improved gasolines of higher octane rating (higher anti-knock value) lies in the increased payloads that can be obtained for the same horsepower of engine. Increased speed is a secondary consideration.

The advantage of using high octane fuel for military aircraft was not computed by Mr. Barnard but he rated its value as even higher because small pursuit planes show improved performance in climb and speed, while big bombers have increased range and greater load-carrying capacity.

Modern design of airplanes shows that with present engines and present gasolines a plane can lift about 10 pounds for each horsepower developed by its motor. The increased saving due to better fuels can only be achieved by the proper design of the motors. Some aviation gasolines now available are "too good" for some of the present airplane motors just as some of the automobile gasolines to-day are too good for a 1927 motor car. Some fuels operate all right but do not bring the benefits, while

potentially they possess, because the motors are not designed for them.

Mr. Barnard's cost studies of high octane gasoline for transport planes indicate that "the earning power of octane number improvements is so great that within practical limits cost can not influence the trend toward higher octane number to any appreciable extent."

AIRPLANE LANDING FLAPS

How unobtrusive and little-noticed landing flaps on the trailing edge of airplane wings can provide a "spare wing" in times of emergency was described by H. D. Fowler, aeronautical engineer of the Glenn L. Martin Company, at the Washington meeting of the National Aeronautic Meeting sponsored by the Society of Automotive Engineers.

Mr. Fowler is the designer of one type of landing flap which, when moved out from its concealed position in the wings, allows the pilot essentially to shift gears and gain from 10 to 15 per cent. greater climbing rate. With one engine out of commission, at a crucial time such as take-off, it is estimated that the flaps increase the climbing rate by 30 per cent. Similarly, the use of flaps in descent permits the airplane to have a lower landing speed and to come down more steeply into a smaller landing field.

Mr. Fowler described his type of landing flap as superior to the so-called split flaps now in general use and explained that the latter had been responsible for some of the recent crashes. Within a year's time three instances where split flaps were indirectly connected with air crashes have been recorded. In two additional instances ice formation on the wings caused crashes. Aptly it has been stated that it is a great safety feature to have two engines—one for spare; several airports—one for spare; several means of radio communication—one for spare, etc.; but apparently one very important factor was not indicated and that is we should have a spare wing ready at all times while in flight to provide just the extra margin of safety.

A major field of usefulness for properly designed flaps is in the long-distance oceanic flying boats and the so-called air-freighters which need superior climbing ability at take-off to get into the air with their large loads. The Diesel-powered German flying boats, which last year accomplished trans-Atlantic trips from the Azores to Long Island, solved this launching problem by the use of catapults from their "mother" ship, but wing flaps can achieve the same objective without this costly and elaborate mechanism.

ITEMS

A NEW island suddenly popped up in the Black Sea recently, off the southwest coast of the Crimea. It is about 800 feet long and 35 feet wide, and its crest stands about 20 feet above sea-level. According to Tass, the official Soviet news agency, a commission of the Academy of Sciences of the USSR investigated the curious phenomenon. It was found that a huge mass of rock from an undercut cliff had suddenly dropped to the sea floor, throwing the bottom into wave-like folds. The new island is the emerged part of one of these folds.

A MOTION picture of the life history of a rabbit egg, from the moment it bursts from the follicle of the ovary, has recently been released by the U. S. Department of Agriculture. This process was never filmed before. A special technique originated by the film's scientific director, Dr. E. I. Evans, made it possible for the photographer, Carl Turvey, to include this early act in life. A uterus containing five unborn rabbits, each in its placental sac is shown, and Dr. Evans opens one of these sacs by Caesarean section. It took two years to make this scientific film, which will be used in the educational work of the department.

THE work of Dr. Earl S. Johnston, of the Smithsonian Institution, and Dr. Paul R. Burkholder, of Connecticut College, indicates that nightly sleep, or something very like it, is as necessary to plants as it is to men and animals. It has to do with the physiological reaction to light on the part of auxins, the substances within plants that cause growth. Strong sunlight was found to be destructive to the auxins, while "controls" containing like amounts of the substances were left with much greater growth-promoting power after being "exposed" to darkness for equal periods. The destruction or inactivation of the growth substances varied with the length and intensity of the illumination. It also varied, as might have been expected, with the species of plant. Some plants, such as the sunflower, are much more sensitive than others—so sensitive, in fact, that its movements seem superficially to be controlled by an animal-like intention. Offhand it might appear somewhat paradoxical that growth should be most rapid in darkness, yet the phenomenon has often been observed. From these experiments it appears that light and darkness play complementary rôles in growth. Light is required for the synthesis of the auxins in the growing tip of the plant, but, once formed, they are most effective as growth's activator in darkness.

A SCIENTIFIC expert at the National Bureau of Standards has approved installations of cameras at race tracks as being accurate and reliable. At the request of the New York State Racing Commission, Dr. Irvine C. Gardner made a study of the optics of the instruments and checked through the fairly simple requirements of installation which would provide true findings. Need for the study arose because in newspapers some sports writers and others had been questioning the method. Dr. Gardner found that with simple precautions the camera would be satisfactory and in all installations he examined there precautions had been considered adequately.

THE biggest oyster-shell in the world is the distinction claimed for an enormous fossil, four feet long and three feet wide, dug up by geologists of the National Park Service in the proposed Big Bend National Park area, in western Texas. Dr. Charles N. Gould, who has been working in the rich fossil deposits of the region, thinks there may even be bigger shells waiting to be excavated. Another fossil discovered in the Big Bend country is a ten-foot petrified tree. No other tree of that size, living or fossil, has ever been found in Texas. The region is also rich in fossils of dinosaurs and extinct elephants.

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Contents for April, 1937

No. 2

- P. WEISS. Further experimental investigations on the phenomenon of homologous response in transplanted amphibian limbs. II. Nerve regeneration and the innervation of transplanted limbs. Five plates.
 P. WEISS. Further experimental investigations on the phenomenon of homologous response in transplanted amphibian limbs. III. Homologous response in the absence of sensory innervation. One text figure.
 T. A. WEAVER, JR. Anatomical relations of the commissures of Meynert and Gudden in the cat. One text figure and three plates.
 L. E. WILEY. A further investigation of auditory cerebral mechanisms. Thirteen text figures.
 J. F. BARNES and H. A. DAVENPORT. Cells and fibers in spinal nerves. III. Is a 1:1 ratio in the dorsal root the rule? One plate.
 K. S. LASHLEY. The mechanism of vision. XIII. Cerebral function in discrimination of brightness when detail vision is controlled. One text figure.
 S. L. CLARK. Innervation of the intrinsic muscles of the eye of the cat. Two plates.
 E. DELORENZI. Bilateral inequality in the number of sensory neurons in the trunk of vertebrates.
 R. ELLIOTT. Total distribution of taste buds on the tongue of the kitten at birth. Five text figures.
 A. O. CURWEN. The telencephalon of *Tupinambis nigropunctatus*. I. Medial and cortical areas. Fifteen text figures.
 W. H. WALLER. A cortical lesion causing cell reaction in the anteromedial thalamic nucleus. Two text figures and one plate.
 K. B. CORBIN, W. T. LHAMON and D. W. PETIT. Peripheral and central connections of the upper cervical dorsal root ganglia in the rhesus monkey.
 J. H. WELSH and C. M. OSBORN. Diurnal changes in the retina of the catfish, *Ameiurus nebulosus*. Four text figures.
 L. A. PENNINGTON. The function of the brain in auditory localization. II. The effect of cortical operation upon original learning. Four text figures.
 A. C. BUCKLEY. Myelination in the central nervous system of the albino rat, treated with thymus extract (Hanson). One plate.

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Contents of Volume 20, No. 4, March 20, 1937

- WOLF, ERNST, and ZERRAHN-WOLF, GERTRUD. Flicker and the reactions of bees to flowers.
 WILBRANDT, W. The effect of organic ions on the membrane potential of nerves.
 EAGLE, HARRY, and HARRIS, TZVEE N. Studies in blood coagulation. V. The coagulation of blood by proteolytic enzymes (trypsin, papain).
 ANSON, M. L. The estimation of papain with hemoglobin.
 ANSON, M. L. The estimation of cathepsin with hemoglobin and the partial purification of cathepsin.
 ANSON, M. L., and NORTHROP, JOHN H. The calibration of diffusion membranes and the cal-

ulation of molecular volumes from diffusion coefficients.

- HERČÍK, FERDINAND. Action of ultraviolet light on spores and vegetative forms of *B. megatherium* sp.
 CROZIER, W. J., and ENZMANN, E. V. Concerning critical periods in the life of adult *Drosophila*.
 SIMMS, HENRY S., and STILLMAN, NETTIE P. Substances affecting adult tissue *in vitro*. I. The stimulating action of trypsin on fresh adult tissue. Plate 1.
 SIMMS, HENRY S., and STILLMAN, NETTIE P. Substances affecting adult tissue *in vitro*. II. A growth inhibitor in adult tissue.
 STERN, KURT G. Spectroscopy of catalase.

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SCIENCE NEWS

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THE INTERNATIONAL SYMPOSIUM ON EARLY MAN

DR. JOHN C. MERRIAM, president of the Carnegie Institution of Washington, opened the International Symposium on Early Man held last week in celebration of the one hundred and twenty-fifth anniversary of the Academy of Natural Sciences of Philadelphia. According to Dr. Merriam few contributions to knowledge have influenced thought more critically than the discoveries showing what man was like in the strange and different Old Stone Age. Skeletal fragments and stone tools, and evidences in the earth showing what the climate, animal life and geographic environment were like thousands of years ago—these things collectively have had a deep and lasting influence upon our views concerning the nature of human kind. Miss Dorothy Garrod, of Newnham College, archeologist, Cambridge, reported that excavations in the caves of Palestine are shedding light on human migrations in the Stone Age. In these caves on Mount Carmel, where Miss Garrod and other workers have been digging out tools and bones of men representing several eras in prehistory, the clues point mainly toward Asiatic relationships for these people, even though they were close to Egypt and North Africa. This link with the North, rather than with the South, is especially true of the Palestine cave dwellers of the late Old Stone Age and in the transition between the Old and New Stone Ages, 15,000 years ago. Explorations in Persia and Anatolia may shed light on the origin of these latter Palestine people, of 15,000 years ago, called Natufians.

PROFESSOR ERNST ANTEVS, of Sweden, now working on American prehistory, said that America appears to have been discovered before the Ice Age ended, over 10,000 years ago. Changes in climate deeply affected ancient man. When the last glaciers melted back toward polar regions in Asia, it appears that roving hunters followed the mammoth and other mammals spreading north. The quest for food led some of these Asiatics across Bering Strait and so they entered the New World. Doubtless the oldest records of man in North America are still hidden in Alaska, his port of entry. Meanwhile, the oldest traces that investigators are able to assign to an estimated time in prehistory, are several thousand miles from Bering Strait in the Southwest. Possibly the oldest records are those near Abilene, in Texas, although a critical study is needed concerning the actual age and conditions of formation of the artifact-bearing beds. Probably the oldest find of the Folsom culture is that at Clovis in eastern New Mexico, which appears to be 12,000 or 13,000 years old. The Pinto culture of the Mohave Desert, 170 miles due east of Los Angeles, may be about equally ancient.

DR. ALEŠ HRDLÍČKA, of the U. S. National Museum, reported that no skeletons have yet been unearthed in America of men earlier than, or different from, Indian types. This would suggest one of two things: either remains of the early hunters are still completely and totally

undiscovered, or Indian types were developed thousands of years ago and remained with little change. American Indians vary remarkably in head type, yet present a basic racial unity. Indians had high or low foreheads, heads long or broad. Some even had skulls practically replicas of Old Stone Age skulls from Europe.

DR. ROBERT BROOM, of the Transvaal Museum, Pretoria, South Africa, reported his recent finding of a skull of the long narrow chimpanzee type with meager brain capacity and human looking teeth. He tentatively gives this ape the distinction of a new species. It bears the name *Australopithecus Transvaalensis* Broom. It lived, he has reason to believe, about the middle of the Old Stone Age or even in the latter part. And that is one of the most puzzling suggestions about it. For by that time in prehistory men were no novelty on earth. Various species of man had evolved and some had already become extinct. Dr. Broom told of unearthing the skull while he was searching South African caves in hope of solving another ape puzzle. Twelve years ago, Professor Raymond Dart had announced the discovery of this other ape, called the Taungs ape, which he considered the long-looked-for missing link, and a near common ancestor of ape and man. As the Taungs skull belonged to a child ape, four or five years old, this was not entirely convincing to the scientific world, and it seemed necessary if possible to get an adult specimen. Comparing the Taungs skull to the one now revealed, Dr. Broom said: "The skull is manifestly closely allied to the Taungs ape, but I am placing it in a new species because the associated mammals are all different, and I think later." Dr. Broom expects to continue the search in caves at Sterkfontein. Before the year ends he hopes to have evidence which will settle the question of age, and to reveal a complete skeleton of the species.

A VIOLENT revolution of the earth, the upheaving and lifting of the whole of eastern Asia, gave China its first human immigrants. This picture from man's earliest days on the earth was brought to the symposium by Pére Teilhard de Chardin, consulting paleontologist of the National Geological Survey of China. Peking Man, China's oldest inhabitant, whose skeletal remains and camp-fire and tools have been found buried in caves near Peking can be used as an index to happenings in his time in Asia, Malaya, India, and Europe. Giving Peking Man the same geological antiquity as Java Man, who is generally rated half a million years old and the oldest and most ape-like type in man's ancestry, Pére Teilhard stated that Peking Man represents an early man of primitive type, close to approaching Java Man. Peking Man is definitely a step below the Neandertal type of prehistoric man. Simianthropus, Peking Man, is perhaps the next to last stage traceable between anthropoids and man. Peking Man arrived in China just after eastern Asia was uplifted in

movement of the earth's crust. Lakes in North China dried up definitely in this geologic revolution. Their sediments were tilted. Rivers cut deep gorges, and thick fans of red clay spread along the slopes. Subtropical animal life vanished from China, replaced by other animals such as deer migrating from the northwest. Water buffalo came up from the south, and from the south, probably, came Peking Man. The water buffalo and euryperiod deer that were contemporaries of Peking Man are seen as significant evidence which will eventually fit China's earliest human chapter to that of central Europe.

At the closing session Professor Oswald Menghin, of the University of Vienna, described bone tools found in Europe and Asia. So crudely are these tools worked that doubt has arisen whether some of these bones were artificially treated at all. Professor Menghin's view is that the bone implements were earliest among the three great streams of culture that developed early in the Old Stone Age. The bone industries had their original home in northern Asia. Later was developed the flake-culture, by which Stone Age man learned to strike a flake from a core of stone. Abandoning the core, the stone-worker would shape the flake into a serviceable tool. This flake-culture probably had its cradle-land in the steppe region of Eurasia. Still later, was introduced a more advanced technique of stone work. This was the core- or handaxe-culture. Stone Age men chipped off fragments from a piece of rock, and shaped the core that remained into a tool. The home of this Stone Age technique is probably India. The cradle-lands for these ancient methods of workmanship are located tentatively by Professor Menghin in parts of the world where only one of the methods was known. In some parts of the Old World, flake-culture and core-culture existed side by side or mixed together.

PROBLEMS of the origin of the Eskimos, and their ancestry in the Old Stone Age were raised by Professor Kaj Birket-Smith, of the National Museum of Copenhagen. The theory that Caribou Eskimos, who live west of Hudson Bay, are "more or less direct descendants of the primeval Eskimos" was advanced by the Danish anthropologist. An analysis of their culture reveals the fact that they have many elements in common with sequestered peoples both in North America and Northern Eurasia and would seem, therefore, that over the whole of this region there are traces of an old common culture. This is far from showing the connection of the Eskimos with the Old Stone Age but it may give a hint of where to hunt for the ancestry of these northern, specialized people. "It is pleasant to record," he said, "that both the International Congress of Anthropological and Ethnological Sciences and the International Congress of Proto- and Prehistoric Sciences have taken up the plans for an international investigation of this important question."

EMILY C. DAVIS

ITEMS

THE Hydrographic Office of the U. S. Navy states that a regular spring patrol of the "iceberg waters" off Newfoundland has been begun. The Coast Guard vessels

Champlain and *Mendota* have been assigned to duty. They will take turns at sea, broadcasting radio reports of any important ice they discover. All ships sighting icebergs or field ice are requested to radio notification to the Coast Guard ship on duty. Either ship will answer the radio call NDIK as well as her own international radio call.

SINCE 1928, the German railways have pioneered in the use of railroad rails 100 feet long to overcome vibrations at higher speeds. With speeds of 100 miles an hour attained on some lines, tests have been completed successfully with rails 200 feet long.

TREES planted in the much-controverted shelterbelt area of the West show high survival percentage despite two years of desperate drought, the U. S. Forest Service reports. Survivals average 550 trees to the acre, out of an average of 740 planted. Chinese elm and cottonwood that were 18 inches high when planted in the spring of 1935 are now 15 and 16 feet high. Species showing best growth include green ash, cottonwood, Chinese elm, red cedar and Ponderosa pine.

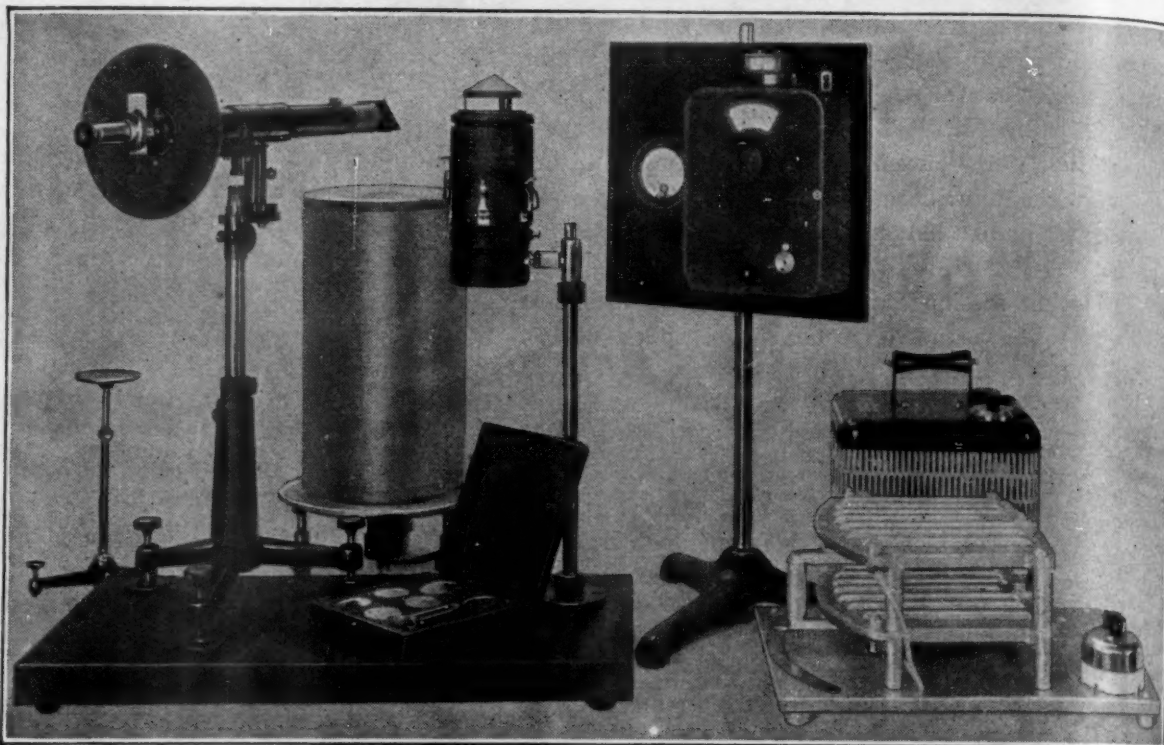
FIRE in the forest, which is now actually used in the South as a tool for the control of yellow pine timber growth, is still wholly "bad medicine" so far as Western white pine is concerned, according to E. F. Rapraeger, of the U. S. Forest Service, who has recently completed a study of fire effects in the great historic timberlands of Idaho. Mr. Rapraeger has studied extensive areas of Western white pine in this region, and finds that the effects of even "mild" ground fires are never beneficial. He found that fire damage was discernible in three different ways: through understocking and reduced yields, through decay started in burn-wounds on the trees and through the encouragement of excessive branching which results in rough timber of lowered market value. Evidently complete protection from fire is essential from infancy to maturity if the aim is to grow Western white pine of high quality.

EUROPEAN bark beetles, that sometimes carry the Dutch elm disease, have been found up the Hudson Valley as far north as Albany and Saratoga, according to a report received from Cornell University. So far as is known, the specimens captured were not carrying the fungus that causes the disease. Extermination efforts are being redoubled in the originally infested area in the New York City neighborhood, with the hope of eliminating all trees that harbor the deadly fungus. The U. S. Department of Agriculture has announced that regulations affecting another important tree disease, the blister rust of white pine, have received certain changes. Maryland, Pennsylvania, Ohio and Wisconsin have been added to the list of states where the fungus-harboring gooseberry and currant bushes within disease-spreading range of economically important stands of white pine must be destroyed. Some modification has also been made in the shipping regulations affecting young white pines in transit.

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THE PRESIDENTIAL ADDRESS AT THE
MEETING OF THE AMERICAN ASSO-
CIATION OF ANATOMISTS
IN TORONTO

DR. FREDERIC T. LEWIS, James Stillman professor of comparative anatomy at the Harvard Medical School, gave the presidential address before the meeting of the American Association of Anatomists recently held at Toronto. Part of Dr. Lewis's address is given here.

The bodies of animals and plants are built of cells which are primarily liquid drops. We begin our existence—turning a deaf ear to Aristotelian and scholastic dialectic—as a spherical drop of liquid. We arise as a cell which has the form of a soap bubble or rain drop. The wonderful globular form of a drop of rain is due to an enveloping skin, which has the properties of a stretched elastic membrane. Robert Boyle, in 1676, warily let fall some drops of oil into rectified spirit supernatant to a solution of niter, thinking to explain the structure of the universe. It was the beginning of physical and chemical studies of the tension which abides in the external layer of the drop, whereby the drop constantly strives to contract and occupy the least possible space. It makes a handsome sphere of the egg yolk or the smaller rabbit's ovum, both of which are single initial cells.

The first drop then divides into a pair, Siamese twinned, joined to one another by a membrane of the same tension as that which covers their exterior. More divisions follow, resulting in a cluster of liquid drops, arranged in accordance with laws established by the Belgian physicist, Plateau, in his masterly study of soap suds (*Statique des liquides*, 1873). Three films, belonging to three bubbles, meet along every edge: six films, belonging to four bubbles meet at every corner. Hence, as shown by Lord Kelvin, an entire bubble, surrounded by other bubbles of the same size and filling space without interstices, will have 14 facets of contact with its neighbors. If the tension of its walls keeps its surface minimal, it will have eight hexagonal facets and six square facets. Cells of elder pith show a recognizable approach to this ideal pattern. Other cells of plants and animals, more irregular in size and arrangement, likewise present the average of 14 facets, though diverse in outline. There are many pentagonal faces. This outcome is a mathematical necessity for liquid drops in masses when obedient to Plateau's laws.

When tension causes three facets to meet at every corner of the faceted drop (and any other arrangement is unstable) then the total number of sides of the polygons covering a cell will be twelve less than if they were all hexagons. In a cube, three faces meet at every corner; the six squares which bound the cube have twelve sides less than six hexagons. This will apply to every cell with 3-rayed vertices, as, for example, to the 14-hedron with its eight hexagonal and six square faces. It is a corollary of Euler's famous theorem for all polyhedra, invented by the eminent Swiss mathematician in 1752.

Under these conditions the cellular mosaic, forming, for example, the epidermis of a cucumber, or lining the human intestine, will approach the hexangular pattern of honeycomb. As the cells grow and divide, pentagonal and heptagonal elements are introduced, but the average of six sides is maintained along the tube. Whenever an element is pushed out, regardless of its number of sides, and the gap is closed with none but 3-rayed vertices, the mosaic loses just six sides. When, by division, a new cell is added, having any number of sides but making 3-rayed vertices only, the mosaic will gain six sides. Under these stringent mathematical requirements, cells present an array of beautiful patterns, complicated by the development of spaces at the corners and edges, where the tension that makes cells round prompts them to separate most readily. For all these patterns there is a simple hydrostatic basis. Cells are fundamentally liquid drops—gland lobules and vascular units are larger drops—all subject to Plateau's laws and to the corollary of Euler's theorem for polyhedra. Thus neatly, in making cells and glands, "nature geometrizes and observes order."

THE STRUCTURE OF THE ANTIBODY

DR. SANFORD B. HOOKER, professor of immunology at Boston University, in giving the presidential address before the American Association of Immunologists, meeting in Chicago on March 24, reviewed current researches on the antibody.

It is considered to be a kind of protein molecule formed by certain body cells when influenced by an antigen such as the toxin of the diphtheria bacillus. This protein molecule, called antibody globulin, is different from other globulin molecules. It has, probably at the surface of each molecule, specific combining groups. The antigen molecule, formed by the bacteria, also has combining groups at its surface. The union of these two is important in producing immunity. Antigen molecules have many combining groups, not necessarily of the same kind. Antibody molecules, formed by the body's cells, have each only one or a relatively few combining groups. The combining groups are thought of as more or less complex patterns of binding points. Those on the antibody molecule are distributed in a pattern that is the mirror image of the binding point pattern of the antigen. The antibody binding points have electrical charges which are the opposite of those carried by the antigen binding points.

One kind of combining group, it is assumed, must contain at least 3 properly adapted points which differ from those of another kind of combining group in atomic nature, spacing and sign and strength of electric charge. A single kind of antigen combining group, if sufficiently complex, may call forth somewhat different kinds of antibody. The perfect "master-key" antibody molecules would be those which most faithfully and completely reflect the physical characters which determine the specificity of the antigen. Such antibody molecules would have

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binding points which could unite effectively with the antigen binding points and neutralize the antigen.

The same antiserum may contain grades of more imperfect and dissociable antibodies extending to the poorest kind whose pattern is so incomplete as to have the least affinity permissive of any recognizable association with antigen. The more of these high-grade antibodies in an antiserum, the more effective will be the serum in protecting against disease.

THE ROLE OF SEX HORMONES IN CANCER

PAIRS of male and female mice, joined Siamese-twin fashion by surgical operation so that they had a common blood supply, have helped to identify the sex hormone that might play a part in breast cancer causation. The studies were reported by Dr. William S. Murray, of the New York State Institute for the Study of Malignant Disease, Buffalo, at the recent Chicago meeting of the American Association for Cancer Research.

One of the female sex hormones, the luteal fraction of the ovarian hormone, is the hormone that may lead to the formation of breast cancer in mice. It has previously been found that the ovarian hormones, acting upon or accumulating in the breast tissues of mice, upset the balance between the various hormones in the body, and instigate the formation of cancers. Whether it was the amount or the kind of sex hormone that led to cancer formation was the question Dr. Murray set himself to solve with the paired male and female mice. Male mice of the strain he studied never developed breast cancer. In breeding females of the strain, breast cancer appeared in from 65 per cent. to 100 per cent. under the stimulation of the hormones of oestrus, pregnancy and lactation, whereas in virgin females the ovarian hormones producing oestrus alone caused breast cancer in only 50 per cent. of the mice.

By pairing the male and female mice so that they had a common blood supply, both came under the influence of the same amount and kind of sex hormones, both male and female. Introduction of the male hormones into the blood stream of the females upset the sexual cycle in the females. The ovaries were stimulated to precocious development of follicles which degenerated so that no luteal tissue or hormone was formed. Neither males nor females developed breast tumors. Since the luteal fraction of the ovarian hormone was absent, Dr. Murray concludes that this is the hormone that plays a rôle in the development of breast cancer in mice.

INDUSTRIAL CANCER

DUSTY air, such as miners, stone cutters and many others work in all day long, is a health hazard and may cause diseases like silicosis, but it is probably not a cause of lung cancer in this country. This is the conclusion of a study reported by Drs. Arthur J. Vorwald and John Karr, of Saranac Laboratory, Saranac Lake, N. Y., at the meeting in Chicago of the American Association of Pathologists and Bacteriologists.

The tendency to regard inhaled dust as a cause of lung cancer was prompted by reports from mining districts in Europe. The number of cases of cancer among miners

there is unusually high. The ore dust in these mines is radioactive and therefore induces changes in the lungs which eventually develop into cancer. These observations do not justify the conclusion that all dusts cause cancer. The great majority of dusts are not radioactive and do not, so far as known, contain cancer-producing substances. If they did, the amount of lung cancer in men and experimental animals exposed to occupational dusts for long periods of time should be unusually high. A survey of patients suffering from pneumokoniosis, the lung condition that is due to breathing dusty air, and observations on patients and animals at the Saranac Laboratory do not support this view.

Cancer and tumors of the bladder can be caused by prolonged exposure to aniline dyes. Experimental proof for this long-suspected relation between the tumors and exposure to the dyes was obtained in studies reported by Drs. W. C. Hueper and H. D. Wolfe, of Wilmington.

FEVER TREATMENT

FEVER treatment does not cure disease by killing disease germs. In diseases like syphilis and gonorrhea, fever should be used with chemical treatment as a means of building up resistance of organs and other body tissues against the germs of the diseases so that "the infection must eventually die away by itself." Professor Julius Wagner-Jauregg, Nobel laureate, who originated fever treatment for the mental disease that is the late stage of syphilis, gave this explanation of how fever helps cure disease in a message to the First International Conference on Fever Therapy. The conference, of which he is honorary chairman, opened in New York on March 29.

Contradicting those who believe that the high artificial fever cures by killing the disease germs, Professor Wagner-Jauregg pointed out that the spirochetes of syphilis are present in the human organism for different periods of time. They are still capable of living even after a successful treatment with artificial fever, whether induced by malaria or by physical means such as short-waves or fever chambers. The same holds true for the organisms of gonorrhea. The patient, however, is well after successful treatment.

Professor Wagner-Jauregg first tried malarial fever as a cure for general paralysis of the insane, late stage of syphilis, in 1917. His success with this kind of fever treatment, in which the fever was produced by deliberately giving the syphilitic patient malaria, started a world-wide wave of fever treatment. Long before 1917, however, Professor Wagner-Jauregg had tried to cure mental diseases by artificial fever. In 1891 he made his first attempts, using tuberculin. Some of these early patients recovered and "enjoy the best health even now, after more than 20 years," according to Professor Wagner-Jauregg. Even before that, as early as 1897, he held that the high fever does not kill the germs, but is an index of the intensity of the curative process running its course.

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projectiles developed at the National Research Laboratories of Canada in Ottawa. Particular merit of the system is its portability which enables it to be used in the field and bring added accuracy to computations of range in actual combat. Light beams, mirrors, photoelectric cells and sensitive recording mechanism are the equipment which makes possible the new development of Dr. D. C. Rose, physicist in the division of physics and electrical engineering of the National Research Laboratories.

In effect the artillery shell passes down a narrow tunnel and every 50 feet intersects a beam of light falling on a photocell. Momentarily the shell blocks off the light beam and this decrease in light intensity cuts down the electrical output of the cell. By an amplifying system this electrical change produces a permanent record on photographic film.

In field tests at the military camp at Petawawa, Dr. Rose set up metal frames whose upper and lower surfaces consisted of mirrors. A beam of light started from the bottom and was reflected back and forth across the space between the mirrors until its ray finally fell on a photoelectric cell concealed in a small box attached to the upper part of the frame. Thus the entire space within the frame was filled with a light beam which could be blocked out by the onrushing shell.

A series of four of these frames were carefully lined up before an artillery piece which at a known, and automatically registered, instant fired its shell through the frames. Initial firing was merely through paper screens to test the alignment of the gun for its "jump" characteristics and to demonstrate that the automatic firing mechanism was working accurately. In subsequent tests the light beams and photocell frames were employed.

The timing of the speeding shells—which were found to be moving with a velocity of 1,585 to 1,600 feet a second—was accomplished by having the weakened photocell current swing a sensitive galvanometer. A beam of light striking a small mirror on this instrument was then reflected back to a moving motion picture film. Simultaneously tiny markings created by a constant pitch tuning fork gave time signals on the film. Some 497.7 of these marks represented one second in actual time.

GRASSHOPPERS IN THE WEST

GRASSHOPPERS, to rival the locust plague of Egypt, menace the crops and rangelands of the United States. Unless spring brings persistent, cold rains when the young insects emerge from the eggs now in the ground, 1937 will go down in history as the worst grasshopper year since the sky-darkened days of the Kansas pioneers.

This warning from the U. S. Department of Agriculture is based on a careful survey of the overwintering eggs now in the ground. Never in this century have there been so many—and the winter weather has done them practically no harm. They are ready to hatch as soon as the ground is thoroughly warm.

The area to be affected covers practically all of the prairie and plains regions, and extends into the intermountain areas of Utah and Arizona. Heavy infestations are reported from the foothills of the Rockies in Montana,

Wyoming and Colorado, eastward to central Illinois. The situation in western, central and southern Iowa is reported as especially menacing. There is an isolated region of severe infestation in the northern part of Michigan's lower peninsula.

Federal and state scientists know how to combat the pest, and farmers have learned to serve as shock troops with the poisoned bran bait which government funds have supplied. A bill to provide money for this year's campaign against the insects is now pending in Congress. If the grasshopper plague develops to its full anticipated strength 84,000 tons of poisoned bran will be required for effective control.

Bran bait is made by mixing coarse bran with an arsenic compound, usually sodium arsenite. Molasses was formerly added, but is now usually omitted. It has been found that sawdust can be substituted for part of the bran.

The prepared bait is spread thinly over the areas where the young grasshoppers, their wings still ungrown, are crawling. It is sown by hand, or with a broadcast sowing machine.

ITEMS

A NEW vitamin, designated with the letter "P" by its Hungarian discoverers, is reported in *Industrial and Engineering Chemistry*. Vitamin P appears to be closely related to vitamin C and, like the better known substance, is found in lemons and paprika. Professor A. Szent-Gyorgyi, of Szeged University, Hungary, who discovered ascorbic acid, is credited with the new find. The exact chemical nature of vitamin P is now being studied but already it appears to consist of a very large molecule containing either 81 or 83 atoms of carbon, hydrogen and oxygen. The compound is said to decrease the permeability of cells to albumin and for this reason is supposed to have vitamin-like properties. The new substance appears to be a natural companion of vitamin C in plants.

CHINA'S appalling famine, that is claiming thousands of lives in Honan and Szechuen provinces, is caused by climatic and geographic factors very similar to those operating in western parts of the United States. These provinces of China, like the Great Plains area in our own country, are on the leeward side of great mountain barriers and the far end of a long journey of the prevailing winds. They are therefore regions of low rainfall in normal times, because most of the moisture has been squeezed out of the air masses before they reach this part of Asia. Even a slight decline in a season's precipitation brings the menace of drought. To these conditions must be added a factor that is less important in the United States. Although these interior provinces are not so densely populated as the swarming areas near the coast, they are still far more thickly peopled than our own Plains region. Therefore a shortage following severe drought makes itself felt immediately. Furthermore, transportation lines such as in this country run supplies into a drought-stricken area are almost lacking in China. Without a local food reserve, with no effective means for bringing in outside supplies, drought means immediate disaster.



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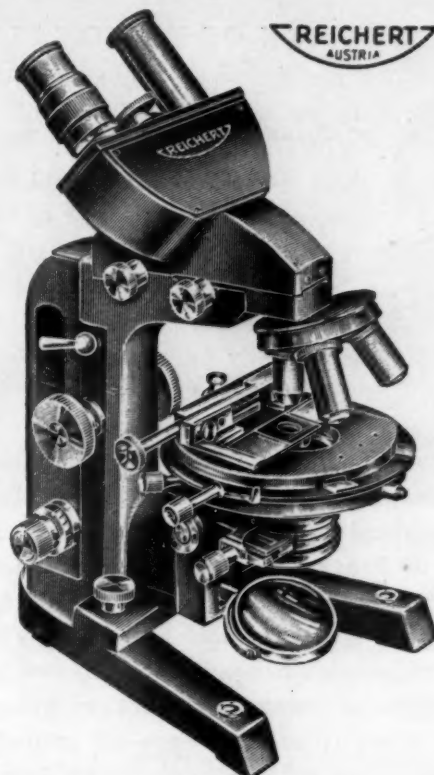
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SCIENCE NEWS

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DISINTEGRATION OF RADIO-LITHIUM

A NEW clue to the structure of the nucleus of the atom has been reported to workers at the Croft Laboratory, of Harvard University, by Dr. J. D. Cockcroft. The clue was contained in an experiment recently completed by Dr. Cockcroft and his associates at the Cavendish Laboratory, Cambridge, the first ever conducted in which the emission of heavy particles has been detected from an artificially produced radioactive substance.

Dr. Cockcroft unexpectedly found that these heavy particles possessed a continuous energy distribution, something never previously discovered in reactions of this type. Dr. Cockcroft's experiments concerned the disintegration of radio-lithium, an artificially radioactive substance produced by bombarding a lithium isotope of mass seven with nuclei of heavy hydrogen atoms, an accepted experimental procedure in the study of the atom.

Not expected, however, was Dr. Cockcroft's finding that "this radio-lithium breaks up apparently not into stable beryllium of mass eight, but in general into a beryllium with a surplus of energy—an excited beryllium eight nucleus. This nucleus subsequently breaks up into two beryllium nuclei which may each have as much as six million volts energy, but in general have less." These are the unexpected heavy particles. The implications or theoretical explanations of the discovery are not yet clear, although it is expected eventually to be of considerable significance. Dr. Cockcroft believes "it may be necessary to assume that the beryllium nucleus of mass eight can exist in one or another of a number of such excited states."

ELEMENT 87

RECENT research at Cornell University may have the ironical effect of destroying one of the school's proudest contributions to science—the discovery in 1931 of element No. 87. Professor Jacob Papish and Eugene Wainer, of the department of chemistry, in that year announced their discovery of this element by using x-ray analysis. In the method, x-rays from a target supposedly containing element 87 were reflected by a crystal of calcite and the resulting spectral lines fitted into positions predicted for the then unknown element.

Now, F. R. Hirsh, Jr., also of Cornell, has performed essentially the same experiment, and used the identical calcite crystal which was a basic part of Professor Papish's apparatus. He finds that the supposed characteristic x-ray lines of element 87 are really produced by the surface irregularities of the crystal itself. Mr. Hirsh has been able to obtain the crucial and important lines when a plain copper target was substituted for the sample in which he was trying to detect element 87.

By a technique called "rocking the crystal" Mr. Hirsh was able also to make the key lines vanish, which proves that the effect was due to the peculiarities of the crystal. If the work is repeated with the same results by an independent investigator, the whole question of the discovery of element 87 will again be thrown open.

In this connection it is recalled that the x-ray detection of element 87 by Professor Papish and Mr. Wainer came at a time when Professor Fred Allison and Dr. E. J. Murphy, at Alabama Polytechnic Institute, were claiming the discovery by the magneto-optic method.

SOLAR DISTURBANCES

SOLAR eruptions, magnetic storms and great outpourings of energy, which are partly invisible and partly visible as sun-spots, are being studied by physicists at the National Bureau of Standards. Disturbances on the sun have lately been found to cause radio fadeouts or times when it is impossible to obtain any radio transmission on high frequencies.

It is this last discovery, made by Dr. J. H. Dellinger and his coworkers in the radio division of the bureau, which provides the diagnostic medium for the sun's energy ailments. At least two different and distinct types of solar radiation have been disclosed by the radio fadeout investigations. There is a sudden effect that produces visible solar activity and practically simultaneous radio fadeout. This, in medical analogy, might be called a twitch of sharp pain which passes quickly.

And there is a longer, more chronic type of solar happening which causes the so-called magnetic storms on the earth lasting a day or two. The sudden effect appears to be caused by electromagnetic radiation of ultra-violet wave-length below the limits of human seeing. These rays penetrate down to the so-called E reflecting layer, about 65 miles above the earth. The more lasting effect which causes magnetic storms and the aurora appear to be due to a different type of solar emission, possibly of the charged particle class. The scene of the effect is much higher above the earth in the F₂ layer at about 200 to 250 miles up.

Dr. Dellinger has been comparing his radio fadeout phenomena with daily bulletins from Mount Wilson Observatory on solar activity and has an additional world-wide check in the twice yearly compilations made in Switzerland from observatories everywhere. His technical report appears in *The Physical Review*.

In the same journal is reported a study of sun-spot activity for the last two hundred years, by A. L. Durkee, engineer of the Bell Telephone Laboratories. Mr. Durkee has tentatively devised a rule which may make possible the forecasting of sun-spot activity. It may also enable radio engineers to have some advance idea of how short-wave radio communication will be affected. The coming peak in the 11-year cycle of sun-spot activity will provide a crucial test for the rule.

Mr. Durkee's method is to plot the ratios of sun-spot maximum and sun-spot minimum from data assembled throughout the world in the last two centuries. Two graphs are possible in this kind of plotting: (1) sun-spot maximum against the preceding sun-spot minimum and (2) sun-spot maximum against the following sun-spot minimum. Mr. Durkee found that the first case provided much better correlation than did the second one.

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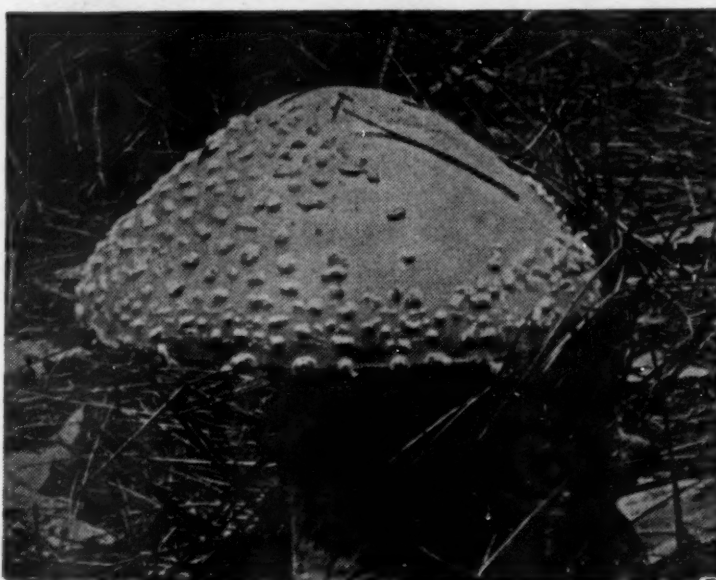
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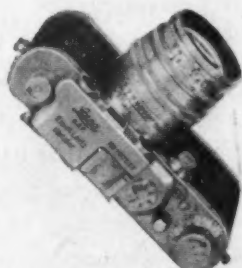
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This study shows that the maximum number of sun-spots, which one may hope to forecast, depends most strongly on the activity in the preceding sun-spot minimum. Using this rule, he notes that in the period from 1932 to 1934 (a minimum era in sun-spot activity) the average number of sun-spots was $8\frac{1}{2}$. The approaching maximum number, therefore, should lie somewhere between 60 and 90 spots. If this forecast is correct it will mean that the average activity during the coming maximum activity will not be greatly different from the moderate values that have occurred during the previous five cycles of 11 years each. In turn, radio engineers may expect short-wave radio transmission will be but little worse than it has been in the past under similar circumstances.

PLANT FOSSILS IN THE MAKING

FOSSILS were not all made and stored in the rocks millions of years ago. The first steps in the making of plant fossils have been seen and reported to the Carnegie Institution of Washington by one of its research associates, Dr. Ralph W. Chaney, chairman of the department of paleontology at the University of California.

When the great triple-peaked volcano Katmai, in Alaska, blew up in 1912, hurling some five cubic miles of ash into the air, part of the finely powdered material settled like snow on the branches of evergreen trees, pulled off billions of their needles, and bore them down to the ground.

Now, a quarter-century after the great eruption, Dr. Chaney has revisited the region and dug down to the bottom of the foot-deep ash. There he found the tree leaves pressed down in a matted layer, mostly in the lower few inches. They closely resembled the matted fossilized leaves he has often investigated in the ancient geological deposits in Oregon known as the John Day formation, which were volcano-formed many millions of years ago.

Of course the single Katmai eruption layer had only a small fraction of the thickness of the John Day formation. Many more eruptions, covering many centuries, would be needed before the Alaska situation would resemble the Oregon beds. But the basic principle is the same; and one man has seen, well within the limits of his working lifetime, the beginnings of a true process of fossilization.

BRAIN WAVES OF NEWBORN INFANTS

ELECTRIC waves led off from the brains of babies on the first day of life, was reported to the Eastern Branch of the American Psychological Association by Dr. J. Roy Smith, of Babies Hospital and Columbia University, New York City.

The waves discovered by Dr. Smith are not the same type as those which have been tapped from the brains of adults. They seem to originate in the so-called motor area of the infants' brains which is thought to control body movements. They are slow waves occurring at the rate of about four or five per second similar to those which have been observed in older children during sleep. Such large slow waves have also previously been found in the motor areas of the brains of Mongolian mental defectives.

The occurrence of brain rhythms so soon after birth

suggests that they have their beginnings even before the infant is born and also suggests the possibility that the brain of the unborn child is already functioning.

A hint that some day brain waves may be useful as an aid to diagnosis of mental deficiencies was contained in the report of Dr. George Kreezer, of the Vineland Training School, New Jersey. He found slight differences between the brain rhythms of defectives of the Mongolian type and those suffering from hereditary defects. He also found that wide differences in mental age are accompanied by differences in brain rhythm.

AMERICAN FOOD HABITS

IF 1,000 New Yorkers are at all typical of the nation's food habits, we don't by any means eat enough protein foods. Meat, fish, eggs and cheese are the chief protein foods. Our general health would be better and we would be mentally and physically more efficient if we consumed more protein in our daily diet.

Drs. Benjamin I. Ashe and Hermon O. Mosenthal have over a long period of years been studying normal, apparently healthy persons who have reported to them for health examinations. By analyzing the 24-hour specimens of urine of these normal persons they have arrived at the protein, salt and fluid intake of 1,000 residents of New York City. Their findings are reported in *The Journal of the American Medical Association*.

Various workers in nutrition state that the suitable daily protein intake is from 75 to 100 grams. The so-called minimal intake is set at 45 grams. In more familiar terms, this minimal intake is a little over an ounce since 28.3 grams are the equivalent of an ounce. One hundred grams is less than a quarter of a pound. Dr. Ashe and Mosenthal were surprised to find that of the 1,000 New Yorkers 61 per cent. ate only 42 grams or even less protein a day. Only 40 persons of the 1,000 ate 75 grams or more protein daily.

"Nutritional" edema, fatigue, anemia, cloudy swelling of vital organs, lack of resistance to infection, plague and other ill effects have been cited by authorities as results of a low protein ration. Women were the chief offenders in the matter of low protein intake. Low and low-normal blood pressure readings were encountered frequently among this group, yet the high protein eaters did not have high blood pressure. Underweight occurred frequently among the low protein group. Mild secondary anemia is common.

Among those who were high protein eaters there were more men. The blood pressure was not high, the weight was average (rarely any overweight) and there was rarely any anemia. The "low salt" eaters were chiefly women, the "high salt" eaters chiefly men. The conclusion was made that persons with high blood pressure do not habitually eat more protein or more salt than normal persons eat. No evidence is found that a low protein diet materially reduces the blood pressure of those with hypertension provided there is no anemia.

NATION-WIDE CENSUS OF NESTING BIRDS

THE first nation-wide census of nesting birds, to be taken by cooperating bird students everywhere, is

announced by William Vogt, editor of *Bird Lore*, official magazine of the National Association of Audubon Societies. During the spring and early summer the volunteer census-takers will do their work, and the results will be published in the October issue of the magazine.

Methods of taking the census, as outlined by Mr. Vogt, indicate that it is a job only for the thorough and patient student of nature. The numerator must select a definite area, from 15 to 150 acres in extent, and make a freehand sketch map indicating its principal features, vegetation type, and so on, and he must spot in every nest of every kind of bird in it. Where nests are too well hidden to be actually discovered, certain other criteria are accepted.

At least five times during the breeding season, at five-day intervals, the territory has to be gone over carefully, and every change in status of nests, bird pairs, unmated males and other details noted. An abbreviation summary method prevents the records from becoming too bulky. It is anticipated that the census will be repeated every year, so that study areas are to be chosen with this in mind.

In addition to the magazine publication of the census summary, the individual record maps are to be made available photographically in microfilm form by the system inaugurated by Science Service. They will thus be collected and kept on file in one central place, and copies can be made quickly and at low cost for any one, anywhere in the world, who wishes to study the detailed records.

ITEMS

THE announcement that the Massachusetts Institute of Technology will build a ten-foot diameter tunnel that will simulate conditions at 35,000 feet altitudes and speeds of 450 miles an hour, brings additional aid to the similar equipment which the National Advisory Committee for Aeronautics is already building at Langley Field. Both wind pressure tunnels follow the general plan and design of the wind tunnel of the Reich Air Ministry at the University of Goettingen at Hanover, Germany. The rarefied atmosphere and accompanying low air pressures encountered in the sub-stratosphere, where aviation now would like to do its flying, render accurate some experimental findings obtained in previous wind tunnels at ordinary atmospheric pressure.

A 200-POUND boulder of jade has been unearthed in ruins of a Mayan pyramid near Guatemala City by an expedition of the Carnegie Institution of Washington. Dr. A. V. Kidder remarks: "We were astounded, for no piece of jade even remotely approaching this in size has ever been found in America before." The rough ball of jade bears scars where Mayan Indian workers had cut thin slices of clear green stone for use in jewelry or ceremonial objects. Why the Indians then buried their treasure at the very center of a pyramid stair is a mystery. The whole boulder was of good quality and might have represented a vast value. Modern investigators have searched without success for the natural source where the American Indians got their much-treasured jade in Mexico or Central America. The American jade is similar

to Oriental jade in appearance, but differs in chemical structure, and in range of coloring.

AN unusually heavy yield by the grapefruit orchards of the lower Rio Grande region is the cause of the haste with which citrus growers are stripping their trees, according to the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture. Because of the danger of invasion by Mexican fruit fly, it is necessary to keep the trees stripped of fruit from about the end of March each year until cool weather comes in autumn. This prevents the insects from breeding, for their larvae must have juicy fruit in which to feed. The big crop this year is making the annual denudation of the orchards more difficult than usual. The Mexican fruit fly is not the same insect as the Mediterranean fruit fly, whose threatened invasion in Florida a few years ago threw the citrus industry of that state into a turmoil. It is, however, a fairly closely related species, with quite similar habits.

WILDLIFE land nearly 5,000,000 acres in extent has been acquired by the government during the past three years, according to Secretary of Agriculture Henry A. Wallace, who spoke at the North American Wildlife Conference at the St. Louis meeting. All federal wildlife sanctuaries acquired in the whole previous history of the country amounted to only about 1,800,000 acres—little more than a third of the new acquisitions. A total of \$20,700,000 has been expended in the purchase and development of these wildlife lands. They are in large part lands in the "submarginal" class so far as profitable use for farming, grazing and forestry are concerned. In their new utilization they not only serve the people as recreation areas and a source of game and fish for food, but also aid materially in combating floods and the manifold evils of soil erosion.

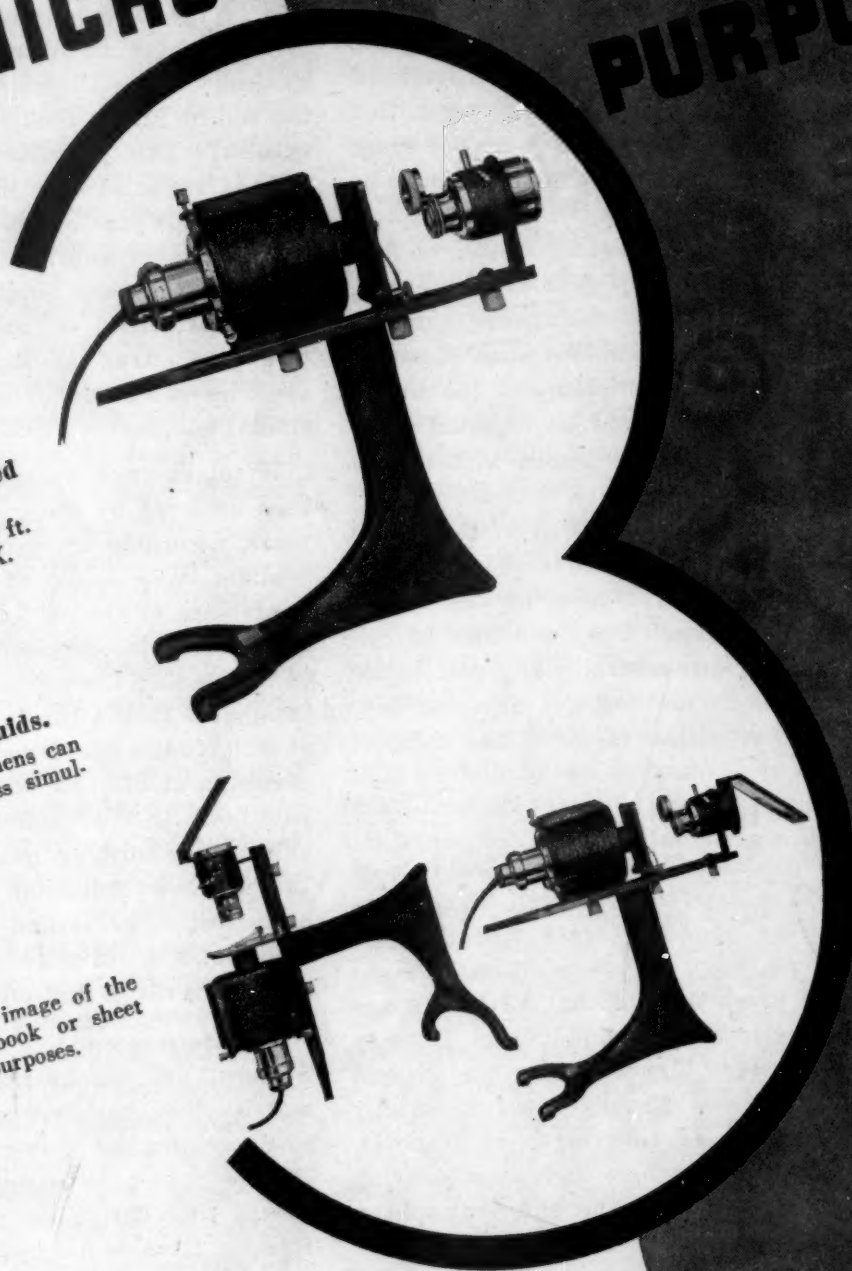
THE terrace-building hot waters at Mammoth Hot Springs, Yellowstone National Park, are showing more activity than has been noted in recent years, according to Superintendent Edmund B. Rogers of the park. The Palette Spring is spreading over a greater area than at any time during the past three years, with the result that the terraces are building up very rapidly at the top and to the east. The coloring of the spring is the most beautiful in recent years. The temperature of the water in the Palette Spring is 143 degrees Fahrenheit. Mound Spring, with water at 149 degrees, is again playing spectacularly from numerous vents along the top of the terrace. Angel Terrace, once one of the leading sights at Mammoth Hot Springs, has exhibited renewed activity with three new vents and a resultant increase in deposition of new travertine. Cleopatra Spring, with a temperature of 158.5 degrees, shows an increased flow. The Baby Spring, which developed on Prospect Terrace three or four years ago, is a little bubbler that changes every month, sometimes almost weekly. Occasionally it ceases entirely, then shows a new burst of activity. At present its terraces and basins are an average of two feet high and 50 feet in diameter. It went entirely dry during February, then started flowing a good-sized volume of water.

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SCIENCE NEWS

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THE THIN FILM METHOD

ONE of the newest tools for detecting the presence of metals in solutions of water in amounts as small as one part in 500,000,000 was described by Dr. Irving Langmuir, of the General Electric Company, at the meetings of the American Chemical Society, at Chapel Hill, N. C. He discussed the details of his thin film method as well as its use in determining the size and some of the properties of the protein molecules that cause the plant virus disease known as tobacco mosaic.

While studies on the tobacco virus are, of course, of major importance to the tobacco industry, this plant disease has a far broader significance to science and medicine. Researches on this virus give indications of being useful in the search for the control of virus diseases which attack man. Human diseases believed caused by viruses include: infantile paralysis, influenza, rabies and small-pox.

The thin films which Dr. Langmuir and his colleagues are studying are generally similar to the familiar oil films which spread on pools of water and show iridescent colors. The really thin films may be invisible to the unaided eye and may only be about one ten-millionth of an inch thick. It is possible to transfer films from water surfaces to glass or other solid objects and to build up thicker films by several dippings. Films of certain substances, such as stearic acid, are extremely sensitive in their properties to the presence of the salts of metals in the solution. One part of aluminum by weight, when added to 500,000,000 parts of water, produces changes in a film that can be detected in several ways.

Copper, silver, gold, magnesium, tin, lead, iron and other bivalent and trivalent metals all create specific differences which, in turn, make it possible to detect the presence of these metals in most minute amounts. For example, water distilled in a condenser of copper, tinned copper, quartz, glass or platinum can be differentiated.

Dr. Wendell M. Stanley, of the Rockefeller Institute for Medical Research at Princeton, N. J., has recently shown that the giant protein molecules which make up the virus of the tobacco mosaic disease are large spherical molecules of a molecular weight of about 17,000,000 and the diameter of molecules of this kind is about 150 times as great as that of ordinary molecules. Dr. Langmuir continued: "This protein can be spread on water and the layers can be transferred to glass where their thickness can be measured. It is interesting to find that the thickness of the film is only about 1/15 of the diameter of the molecules from which it is formed. Evidently, therefore, these giant molecules unfold themselves in a remarkable way when merely allowed to spread on the surface of water. The thickness of the films obtained from these giant molecules seems to be the same as that obtained from other protein molecules which are only about 1/500 as large. This lends support to a theory which has been recently advanced that all proteins tend to spread

out on surfaces and when they do so they all have a similar lace-like pattern."

ROBERT D. POTTER

THE STUDY OF COMPLEX CARBOHYDRATE COMPOUNDS

IN an invited lecture before the recent meetings of the American Chemical Society, Professor Claude S. Hudson, chief of the Division of Chemistry, National Institute of Health, Washington, D. C., described his new experiments on breaking up complex carbohydrate compounds, with their long chains of carbon atoms, into simpler component parts whose structure can be determined. This knowledge of the parts gives a more quantitative idea of the original complex compound. These experiments are analogous to the study of a foreign language where one takes a complex sentence and finds the meaning of the component words and thus arrives at a better knowledge of the original sentence.

A practical aspect of Dr. Hudson's research is the fact that the changed chemical structures of the carbohydrates form a starting point from which the organic chemist can build up new products. New medicinal products and materials with industrial uses yet unrealized are only two logical possibilities.

Of significance is the fact that in the splitting of the long chain of carbohydrates and the addition of an oxygen atom to them, the process turns them from inert chemicals with little combining characteristics into products that combine readily with other things.

Significant, too, in the research on the carbohydrates is the fact that it is basic, long-range work on the chemistry of the future. The carbohydrates of plants—the sugars, cellulose, starches and so on—are the raw materials of the annual crops; renewed with each year's growth. With the passing of decades and centuries and the gradual decrease in the world's mineral resources, man—through the chemist—will necessarily have to turn more and more to the utilization of the products of the plants.

ROBERT D. POTTER

RADIOACTIVE POTASSIUM

AT the meeting of the American Chemical Society, Dr. A. Keith Brewer, of the U. S. Bureau of Chemistry and Soils, described new research on the atomic weight of potassium in animal tissue, which is another step forward in determining potassium's rôle in life. Dr. Brewer has determined the ratio of the two forms of potassium called K 39 and K 41 in plants, minerals and a large number of animals; also in fast-growing embryonic tissue, in bone marrow and other body tissues.

The fundamental importance of studying the rôle of potassium in living things can better be appreciated by recalling that Zwaardemaker found that the removal of potassium from the blood stream would stop the heart beat. Moreover, he found that if radioactive material

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were substituted for potassium in the blood, the heart would again start to beat. Also he found that if the heart were merely radiated by radioactive material it would start to beat. This finding was substantiated by Dr. Jacques Loeb, of the Rockefeller Institute for Medical Research, but it was also found that the metallic element caesium would similarly start the heart to beat. This seemed to be the only exception to the general rule that radioactivity could equal the element potassium in causing heart beats.

The next step was the speculation—and admittedly it still is such—that perhaps it was the radioactive kind of potassium, the K 41 form, which was the crucial factor. Moreover, experiments at Prague had shown that seed germination was markedly speeded by the presence of K 41. In seeds where perhaps 20 out of a hundred would germinate naturally, the number was increased clearly beyond any experimental error in the presence of radioactive potassium.

Dr. Brewer's report indicates that a high proportion of the radioactive kind of potassium appears to be associated in animals with embryonic tissue. Bone marrow, for example, is rich in K 41 compared with other tissues of the body, and the concentration grows less with the maturity of the animal. Interesting, too, is the fact that a mature animal which had developed cancer and therefore had a more than normal abundance of embryonic tissue in its body showed an increase in the K 41 content of its tissues. The heart, he reported, is relatively low in its K 41 content and has relatively more of the non-radioactive K 39 kind of potassium present.

Dr. Brewer's studies were made with the aid of a large atom "scale" known as a mass spectrograph which determines the weights of the atoms in an element. His present studies on animal tissues are the culmination of a similar line of research on potassium which has included the analysis of sea-water for this element, down to a depth of two and one half miles; a study of the ratio of the two kinds of potassium in minerals from all over the world and an investigation of the same thing in plants.

The ratio of the two varieties, and hence the average atomic weight, is sensibly constant in sea-water and in minerals; in plants, with the exception of kelp, which seems to have the ability to concentrate the radioactive form, and in potato vines where the older vines show more of K 41 than do the younger ones.

ROBERT D. POTTER

NEW INTERSTELLAR GASES

THE discovery of several new interstellar gases, two of which have been identified as neutral potassium and calcium, has been made by Dr. Theodore Dunham, Jr., astronomer at the Mount Wilson Observatory. Space between stars is filled with atoms of various elements, and Dr. Dunham's research brings the total identified to four, one of which, calcium, appears in two forms.

Ionized calcium was the first interstellar gas to be discovered, and the discovery of neutral calcium by Dr. Dunham is considered remarkable because it is estimated that each cubic yard of space contains but one atom. Detection of this element was made possible by the de-

velopment of delicate apparatus and an improvement in photographic plates.

Using light from the stars Chi Orionis and 55 Cygni and new ultra-sensitive infra-red photographic plates at the Coude focus of the 100-inch telescope, evidence was obtained for the existence of neutral potassium. Previous interstellar elements detected include ionized calcium, sodium and titanium. Dr. Dunham and Dr. Walter S. Adams, director of Mount Wilson, announced the discovery of titanium last fall, the first new interstellar gas detected since about 1915. Because the intensity of the lines in the spectrum produced by the newly discovered interstellar elements varies from star to star, Dr. Dunham suggests that the distribution of gas throughout interstellar space is far from uniform.

THE CAMBRIDGE MEETING OF THE AMERICAN ASSOCIATION OF PHYSICAL ANTHROPOLOGISTS

PAPERS presented at the Cambridge meeting of the American Association of Physical Anthropologists, of which the following are brief abstracts, include:

New evidence that close inbreeding of human beings has no ill effects if the original stocks were biologically sound was presented by Dr. H. L. Shapiro, of the American Museum of Natural History. The present population of Pitcairn Island, 202 persons, are descended from one of the mutineers of the famous ship *Bounty*, who settled on the island in 1790, with a dozen Tahitian women. "Inbreeding has been common to such an extent that practically every one is related to all the other members of the community. Despite this inbreeding the islanders are healthy, vigorous and are free from the stigmata of degeneracy. This finding confirms the inbreeding experiments of the laboratory which demonstrate that inbreeding as a process does not lead to disaster. The evil consequences which occur in some inbred stocks may more correctly be attributed to latent defects which are intensified and brought to the surface by inbreeding."

Blood group tests, such as sometimes figure in cases of disputed parentage brought before the court, can be performed on the long-time dead as well as on the living. A report of such tests carried out on 300 mummies, including Egyptian, Peruvian, Basketmaker and ancient Aleutian Indians of Alaska, was presented by Drs. William C. Boyd and Lyle G. Boyd, of Boston University.

Brains of the lower members of the primates are remarkably symmetrical, in contrast to the usually somewhat unevenly balanced brains of the higher primates including man, according to Dr. C. J. Connolly, of the Catholic University of America. Dr. Connolly worked on the large collection of primate brains in the U. S. National Museum. In all, he studied 210 brains, representing 40 different species. The symmetry which he discovered was expressed not only in the evenly matched sizes and shapes of the opposite halves of the brains, but also in their principal furrows or sulci. Brain forms changed and the position of the furrows also, with advancing age. This indicates the existence in the brain of centers of more active growth. This shift is carried much further in the higher apes and in man.

Iraq is a small kingdom, with only 3,000,000 inhabitants, but it contains a large mixture of races. Studies of these were reported by Henry Field, of the Field Museum of Natural History, Chicago. For 5,000 years and more, the land now called Iraq has been a crossing place for folk migration routes. Mr. Field distinguished four principal racial elements: the Proto-Mediterranean stock, the nomadic Bedouins of the desert, the settled Arabs of the towns, and the Kurds. But besides these there are many interesting small groups, such as the Assyrians, the Chaldeans, Turkomans, Subba and Marsh Arabs.

BIRD STUDY

AIRPLANES and sound-films are among the means and methods used by modern science in investigating the lives of birds. The evolution of up-to-date study methods from elementary beginnings was described in a lecture by Dr. A. A. Allen, professor of ornithology at Cornell University, delivered in Washington on April 8.

With airplanes, migrating birds have been intercepted at various heights up to 12,000 feet and their speed of flight recorded. This varies from 20 to as much as 75 miles per hour, with greater speeds open to question. Numbered aluminum bands up to nearly two million have been placed on wild birds so as to trace their travels, determine their longevity and aid in the solution of other problems.

Laboratory experiments with controlled lighting have been performed on a number of species. These indicate conclusively that the migratory instinct is closely associated with the enlarging of the reproductive organs, and that this process is dependent upon the lengthening days. By merely artificially lengthening the bird's day, it can be brought into breeding condition in the middle of winter. This helps to explain not only the cause of migration but also the regularity of bird arrivals in the spring. The meaning of song and how birds recognize one another are likewise coming under the scrutiny of ornithologists in a series of well-planned experiments. The songs and calls of birds are being recorded accurately on film where they can be studied and compared, as are other scientific data.

Wildlife management methods, some of which were used in the thirteenth century but have lain dormant ever since, are being revived, improved upon, and put into practice in this country not only for game species but for song birds as well. Nine state universities have recently started research projects along these lines, cooperating with the U. S. Biological Survey and the American Game Warden's Institute. Other universities are carrying on research and instruction in this field and a new Wildlife Society has recently been formed. The study of individual birds by marking with brightly colored feathers or colored celluloid bands so they can be recognized at a distance is greatly facilitating many ornithological studies.

ITEMS

A DRIFTING bottle crossed the Pacific Ocean in a little less than two years, traveling more than 8,000 miles, the Hydrographic Office of the U. S. Navy has been notified. The bottle, with an identifying paper sealed inside, was dropped overboard the American steamer *Birmingham* by

Second Officer J. J. Parrilla on January 19, 1935. The ship was then in latitude 14 degrees, 19 minutes north, southwest of Mexico. On January 14, 1937, it was found on the island of Antau Su, near Taiwan (Formosa), in approximately latitude 22 degrees north, 121 degrees 30 minutes east.

BLACK WIDOW spiders were known to the Aztecs of pre-Columbian Mexico. The Aztecs knew, too, that the spiders were poisonous, yet they were not afraid of them. For they knew another thing, which few present-day white men are willing to believe—that the black widow's bite is rarely fatal, even though it may make the victim uncomfortably ill for several days. Dr. C. H. Curran, of the American Museum of Natural History, has dug up out of old Spanish records the notes about the black widow set down by the scholarly missionary Sahagun, to whose encyclopedic writings about Mexico the modern world owes the larger part of its knowledge of Aztec life. Sahagun estimated the black widow briefly, but correctly: "There are some poisonous spiders in this country, they are black and have a reddish tail. The stings cause great fatigue for three or four days, although they do not kill with their sting." Aztec doctors treated black widow bites with compresses soaked in an alkaline solution, and also gave the patient an alkaline drink. Complete rest for several days was a necessary part of the cure.

IN the last six years the number of fast trains in the United States has increased more than thirteen times. According to a report in *Mechanical Engineering*, there are more than 400 trains in the nation which now operate at scheduled speeds of 60 miles an hour or better, while in 1930 there were but thirty such trains. This trend to higher railroad speeds is not wholly confined to the United States. In France, the Riviera express from Paris averages 59 miles an hour over 318 miles of curved, difficult route through hilly country. In Austria electric trains through the mountains operate at nearly the maximum speeds which the curves will permit. Even Switzerland, where distances are short and the urge for speed might seem less, is building three trains with top speeds of 93 miles an hour. The trend to higher speeds is not solely an effort to catch and hold the public's imagination and patronage. The German State Railways, for example, estimate that their increase of speed, of 11 per cent., between 1932 and 1935, has resulted in economies of 9 million dollars, due to more intensive use of rolling stock and personnel, in spite of rising repair and traction costs.

THE State Institute of Testing Materials, in Berlin, where the strength of concrete, girders and beams is usually tested, has recently turned to a study of the mechanical strength of human bones. Knowledge of value in osteopathic surgery has resulted for it has been shown that the same laws of physics governing ordinary materials can be applied to bone fractures. It was also found that at the moment of fracture there is a local rise of temperature of over eight degrees which may result in fever symptoms.



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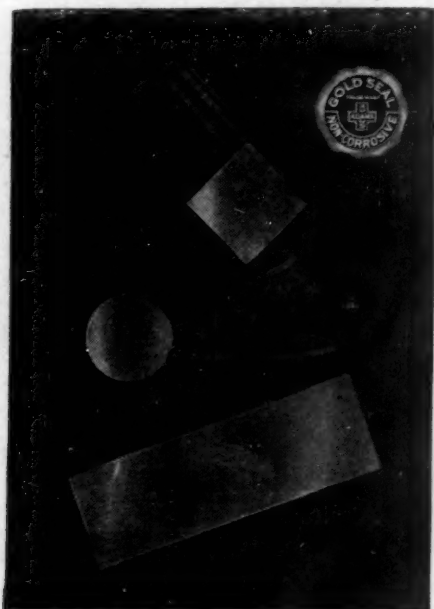
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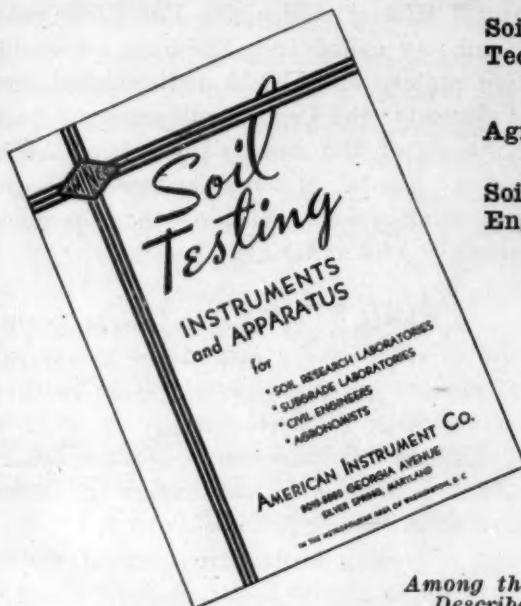
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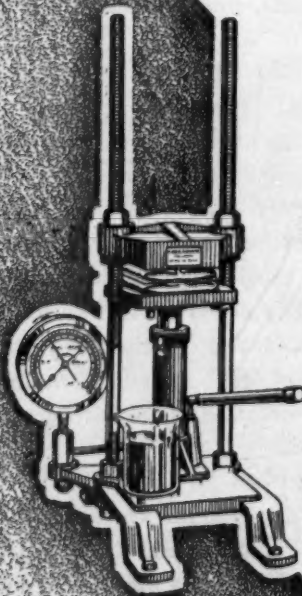
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SCIENCE NEWS

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SELENIUM OXYCHLORIDE AS A SOLVENT

IN reporting a five-year study of the solvent, selenium oxychloride, at the recent meeting of the American Chemical Society, Professor Gilbert B. L. Smith, of the Brooklyn Polytechnic Institute, said, "such strange things happen to substances dissolved in this solvent that chemists must revise their theories of ionization as applied to acids, bases and salts."

Selenium oxychloride is a heavy straw-colored liquid that freezes at about 65 degrees Fahrenheit. It has a corrosive action on many common materials. Describing its oxidizing properties, Professor Smith said: "Once some of it froze over night, broke its containers and dripped on the wooden floor of one of the laboratories at the institute. It ate right through the floor and dripped down into the physics laboratory below. The selenium oxychloride destroyed several instruments in the physics laboratory and even attacked bakelite fixtures."

To picture to his audience the strange properties of selenium oxychloride, Professor Smith described the world as it might be if it was as prevalent as water and took its place as the widest known solvent. Then mountains would consist only of glass or feldspar, two of the few substances which the solvent will not dissolve. All bridges and boats would have to be constructed of platinum or tungsten. From the time the temperature fell below 65 degrees in the fall, the whole world would be a great frozen mass. Snow would fall every time it became colder than in mild spring time and when it rained it would be necessary to use umbrellas made of glass, tungsten or platinum.

VITAMIN B

VITAMIN B, alone among the major vitamins so essential to health, is the one most lacking in modern diet, according to Dr. R. R. Williams who gave an invited address at the meeting of the American Chemical Society, Chapel Hill, N. C. Dr. Williams, chief of the Bell Telephone Laboratories, isolated, analyzed and synthesized vitamin B, and is now making it available to research workers on a relatively mass production scale. He said: "In some ways, we have materially bettered our diets in recent years. The rising use of dairy products provides more vitamin A, the vogue for sun tan and irradiated foods more vitamin D, the greatly increased practice of distributing fresh fruits and vegetables throughout the year by means of refrigeration more vitamin C, but we look in vain for any such significant upturn of our vitamin B intake."

Vitamin B is found most prevalently in outside bran coats of grains, and in ripe peas and beans and in lean pork. Since, however, ripe seed vegetables are often cooked for a long time to render their proteins more digestible most of their vitamin B may be extracted before they reach the table. Lack of vitamin B is known to cause the serious disease of beri-beri which is widely prevalent in the Oriental countries where a polished rice

diet has supplanted the former hand-hulled rice. It may be necessary to slowly change the eating habits of millions of people there before the disease can be conquered.

In occidental countries the ways in which the body utilizes vitamin B is now being studied. In Chicago a B-rich vitamin diet is being fed to dementia praecox patients. The test is so newly started, however, that definite results are yet unavailable. Dr. R. A. Peters, of the University of Oxford, has found that as the body supply of vitamin B increased the oxygen intake is stepped up proportionally, especially in the brain and the kidneys.

THE GEORGIA CHEMURGIC CONFERENCE

AT the Georgia Chemurgic Conference, held recently at Macon, Ga., Carl B. Fritsche, managing director of the Farm Chemurgic Council, explained the objectives of the farm chemurgic movement. An effort is being made to find industrial uses for farm products which will enlarge the demand for staple crops and which possibly will introduce new ones.

For instance, the adhesive used on postage stamps is made from an imported starchy raw material. Chemists of the U. S. Department of Agriculture have proved that an adhesive just as good, for stamps, envelopes and for many other purposes can be made from sweet potatoes. This is only one of the items in the possible industrial usefulness of the sweet potato, according to W. I. Ritchey, manager of the Laurel Starch Plant, of Laurel, Miss. Laundry starch of high quality is another sweet potato product; also sizing, used to give smooth attractive finish to paper and yarns. The sweet potato starch industry bids fair to make profitable use of the large percentage of culls thrown out when the vegetables are prepared for marketing as food. It may even necessitate the raising of large special crops to keep the factories fed.

W. S. Anderson, also of the Laurel Starch Plant, spoke on some of the practical problems connected with raising, harvesting and storing the sweet potato before they start through the starch mill.

Hitherto all tung oil, which is much in demand for paint, varnish and linoleum, has been imported from China and its now divorced province of Manchuria. The trees have never been cultivated there; the nuts have been merely harvested from wild trees, and the quality of the oil has been far from uniform due to primitive methods used in pressing, as well as a tendency to adulterate. Tung trees were first planted at Gainesville in a tentative small-scale way something over a dozen years ago. Now there are large plantations of them in various parts of the gulf region. Even yet, however, the American product supplies only a small fraction of the demand.

An entire session was given over to discussion of the wine possibilities of the famous Scuppernong grape, by Paul Garrett, of Atlanta, and H. P. Stuckey, director of the State Experiment Station. Certain legal aspects of the matter were discussed by Dr. M. Ashley, professor of law at the University of Georgia.

SERUM IN THE TREATMENT OF PNEUMONIA

THE most powerful weapon the modern physician can use to fight pneumonia, which takes an annual toll of more than 100,000 in the United States, is specific immune serum, according to Dr. Edward L. Bortz, of the Post-Graduate School of Medicine of the University of Pennsylvania, who spoke at the Post Graduate Institute of the Philadelphia County Medical Society and the First District Councilor Meeting in Philadelphia.

Describing the dramatic results obtained with serum in treating pneumonia, Dr. Bortz said: "From a desperate, acute, consuming illness with a dangerous temperature, chest pain, restlessness, paroxysms of cough, and approaching delirium, the prompt administration of the correct serum will sweep away the toxemia, the temperature will fall, the pain in the chest will disappear, the pulse and respiration return to normal, the cough is quieted and the patient finds himself practically a well man, emerging as it were, from an evil dream."

Turning to statistics, he stated that the high pneumonia death rate can be cut at least fifty per cent. by modern treatment, which means prompt diagnosis and treatment with the appropriate serum. Diagnosis in pneumonia means determining by laboratory test of the patient's sputum which of the many pneumonia germs are causing the disease in a particular case. This test is called typing and the germs are known respectively as Type I pneumococcus, Type II pneumococcus, and so on for all the different members of the pneumonia germ family. Unfortunately, curative serums have not been developed for all the pneumonias, but where they have, their use will save thousands of lives. Nutrition, elimination, rest and nursing care are other important factors in the treatment of pneumonia. Dr. Bortz said that oxygen is an important aid, but that its use unfortunately has not affected the mortality rate.

ITEMS

CONTINUED cold and stormy weather, with much snow and rain, definitely puts 1937 down as a late-spring year, according to the U. S. Weather Bureau. Over the greater part of the great interior farm areas spring work is from ten days to three weeks behind schedule. Additional snows in the northern Great Plains area, and rain in the intermountain regions, raised the water content of the none-too-well moistened soil. Rains helped also in the Middle Atlantic states.

TABLE salt rich in vitamin B is now a distinct possibility. Professor L. R. Cerecedo, of Fordham University, has found that synthetic sand-like materials, of the general nature of the zeolites used as water softeners, have the ability to take up vitamin B from cereal and yeast extracts. These synthetic vitamin sponges retain the vitamin until they are treated with a salt solution when they transfer the vitamin to the salt solution. After evaporation of the water in the salt solution a residue rich in vitamin B is obtained. The amount of vitamin B

in the amount of salt ordinarily shaken on food at the table would be more than sufficient to supply that which is known to be lost in cooking because of heat and water extraction. It appears probable that the amount of vitamin B which could be obtained from the daily sprinklings of salt would equal the vitamin obtained by eating three yeast cakes.

BUTTERFLIES and moths will soon be breaking out of the cocoons where they have spent the winter, fast asleep as chrysalises. But what induced the caterpillars to spin themselves into their silken shrouds and go into the deep sleep of change. Two German zoologists, Drs. Alfred Kuhn and Hans Piepho, have found at least part of the answer. An internal gland secretion gathers in the brain of the caterpillar, and when its concentration has reached a certain point the caterpillar is irresistibly impelled to spin itself in. This "pupation hormone" is unknown except in caterpillars. Its chemical formula has not yet been fully worked out.

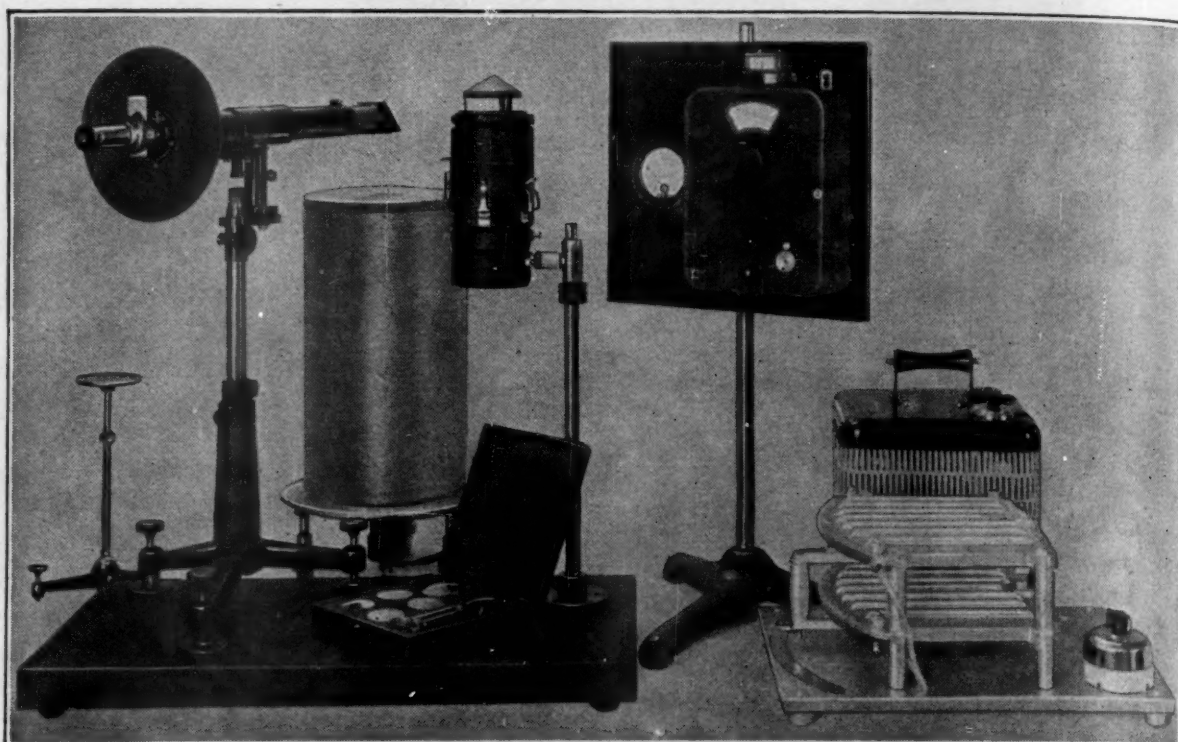
A NEW male sex hormone, known as epiallopregnalone, has now been isolated and made synthetically, it was announced to the meeting of the American Chemical Society, by Dr. R. E. Marker, of Pennsylvania State College, on behalf of his colleagues, R. V. McGrew, E. L. Wittle and D. M. Jones. In most minute amounts this hormone aids the development of male sex characteristics in birds and other animals, including man. Two other male sex hormones have previously been obtained, testosterone from the male sex glands, and androsterone. Dr. Marker believes that the sex hormones do not act primarily as physical stimulators of specific organs, but rather by chemical combination in the body. This supposition is strengthened by evidence showing that when the sex hormones are administered they can not be recovered in their original form. They are recovered as decomposition products, showing that they have entered into chemical combination in the body.

A MAJOR forward step toward the chemical synthesis of chlorophyll, the green coloring matter of plant leaves upon which depends nearly all life on earth, has been made. About seventy compounds closely related to chlorophyll have been prepared and some of them have strange and powerful physiological properties. One compound, for example, was injected into rats in small amounts of ten milligrams and virtually bound the animals to a life of darkness in order to live. As long as they remained in the dark they showed no effect. When removed to daylight they died in a few hours. Dr. Paul Rothenmund, of Antioch College, in describing his researches on these chemical relatives of chlorophyll, at a meeting of the American Chemical Society, also told of a German chemist who tried some of the substance on himself with the result that he too, was bound to a life "after dark." For ten months he could not go out into the light without having his face swell up, suffering intense pain, and having patches of his hair fall out.

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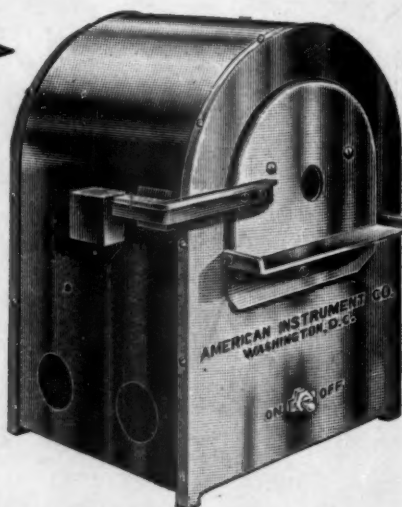
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By GLENN T. TREWARTHA, University of Wisconsin. *McGraw-Hill Series in Geography.*
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SCIENCE NEWS

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THE MEMPHIS MEETING OF THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

PAPERS presented at the Memphis meeting of the Federation of American Societies for Experimental Biology include the following:

Dr. Leo Loeb, of Washington University, discussed the recognition of one body cell by another by chemical means. "Individuality differentials" is the term used to describe the means by which cells make their identification. It is by these chemical differentials that cells know, in case of skin grafting, for example, whether the new skin comes from another part of the patient's body or from a relative's body or from a stranger. If, instead of skin, some other tissue is transplanted, the cells also recognize whether it comes from the same individual or from a different individual; but the cells do not distinguish between liver, thyroid or other organs; they are not concerned with the difference between organs, but only with differences between "individuality differentials." If a gland is transplanted from a rabbit to a guinea-pig, the cells in the surrounding tissues of the guinea-pig can tell that it does not belong to their own species. If the grafted gland came from a guinea-pig, the cells recognize the transplant as belonging to the same species, although to a different individual, and if the graft was from a litter mate the fraternal relationship is recognized by the cells. All this is possible because certain chemical substances are produced by the body and are present in each piece of tissue. These substances are given off by the tissue if it is transplanted; they first spread into the area surrounding the graft and then into the bloodstream and thus are carried to distant organs of the body. It is these substances which enable the cells to recognize whether the graft was part of their own body, of that of a relation, of a non-related individual or of an individual belonging to a different species. This chemical personality or individuality is highly important. It protects the body because it gives the cells power to recognize alien and possibly hostile cells. It also is evident when attempts are made to graft skin or other tissue from one individual to another individual of the same species or from one species to another. The grafts "do not take," it is said, but the reason is that the cells of the recipient have recognized the foreigner and they as well as the blood are reacting against him.

FROM a survey of brain-wave research reported by Dr. Hallowell Davis, of Harvard University, it appears that each person has his own individual brain-wave pattern, but for purposes of identification these patterns are not as good as finger-print patterns. The brain waves, which are electrical waves continuously generated by the gray matter of the brain and spinal cord, represent the organized activity of many cells. In some cases the organization is due to the fact that many brain cells are simultaneously stimulated by incoming impulses from the sensory nerves. A bright light striking the nerves of

sight, for example, sends in the impulses which stimulate brain cells to produce an electrical wave. Electrical waves are produced by the brain cells as a result of other stimulation, such as acute injury and certain drugs. The character of brain waves varies according to the kind of physiological activity going on in the brain. Very slow and often irregular activity occurs during sleep, anesthesia, coma and fainting. Epilepsy and brain tumors each cause definite types of brain-cell activity as seen in the brain-wave patterns. Diagnosis of such brain ails, it is hoped, may some day be made from the brain wave patterns. In normal persons the pattern of electrical activity in the brain is characteristic. Identical twins have practically identical patterns, although ordinary twins and other persons each have their own individual patterns.

EPILEPTIC attacks might be prevented if the patient's breathing could be regulated to an even rate of inhaling and exhaling, it appears from research reported by Dr. Frederic A. Gibbs, of the Harvard Medical School. This is because the stop and go system which regulates the breathing movements also affects the rate of brain-cell activity. The brain-cell activity generates rhythmic electrical waves, popularly called brain waves. A record of these brain waves is, except for the time scale, very much like the record of breathing movements. When breathing is slow, the brain waves are slowed, and the reverse. Measures which correct disturbances of the breathing rate tend to correct and prevent the comparable disturbances in brain-wave frequency which occur in epilepsy. Conditions which cause sudden changes in breathing rate because of their effect on brain-wave frequency bring on epileptic seizures.

DRS. J. REBOUL, H. B. Friedgood and H. Davis, of the Harvard Medical School, reported their experimental method of detecting the moment of ovulation in the rabbit by electrical means. When the egg cell bursts from the sac in the ovary a characteristic electrical change occurs. This was detected by means of a vacuum-tube potentiometer activating a moving-coil galvanometer. The research confirms earlier work reported by Professor H. Burr and associates, of Yale University. What gives the signal for the egg's escape from the ovary is not known exactly, but a hormone from the pituitary gland plays a part. Drs. H. O. Haterius and A. J. Derbyshire, Jr., of the Ohio State University reported that the process has now been induced in rabbits by electrically stimulating a definite area of the brain. The region is localized and is situated in the part of the brain called the hypothalamus, to which the pituitary gland is attached. It is probably directly above and behind the optic chiasm which is where the fibers of the optic nerve cross on the underside of the brain. Ovulation occurs after stimulation of this particular region of the brain, but Dr. Haterius and Derbyshire stated that there is as yet no evidence that ovulation occurs because of the stimulation

THAT one of the male sex hormones, testosterone, may be a valuable remedy for prostate gland disease, was suggested by Dr. Harold P. Rusch, of the University of Wisconsin Medical School. The hormone may undo some of the damage done in the disease. Recent research has shown that certain changes of the gland tissue are the result of a relative decrease of male hormone in relation to the amount of female hormone present in the male body. Changing these proportions of male to female hormone by giving female hormone to mice caused changes in their prostate glands similar to those seen in man. In the experiments reported, Dr. Rusch was able to reverse some of the changes by giving male sex hormones to the animals.

THE cause of angina pectoris is laid to stomach spasms, in a new theory reported by Drs. D. E. Jackson, Russell N. Speckman and Helen L. Jackson, of the Medical School of the University of Cincinnati. In their opinion "angina pectoris is really due to acute, spasmodic, incoordinated contractions of the esophagus or stomach or of both simultaneously." As a result of these contractions air or other stomach contents may be entrapped in the esophagus. Complete rupture of the organ, usually at the lower end of the esophagus, has occurred in a considerable number of these cases. X-ray studies often make it possible to see these contractions, bulgings and other abnormal conditions in the esophagus. The location of these abnormalities has a direct bearing on the distribution of the pain of which the patient complains. Nitrites, and-by medicines for patients with angina pectoris, relieve these patients by relaxing the smooth muscle of the esophagus or stomach. If the drug, which acts only locally, does not reach these muscle fibers in sufficient concentration, relief may not occur. Angina pectoris has been one of the unsolved mysteries of medicine for nearly 70 years. Some 80 different theories have been proposed to explain this painful and often fatal affliction.

EXTRACT of the cortex of the adrenal glands may be part of the athletic trainer's equipment in future, if the suggestion seen in a report by Drs. Fred A. Hitchcock and C. Grubbs, the Ohio State University, can be acted on. This gland extract tends to increase the muscular efficiency of normal men and women. Its effect is seen in the decreased consumption of oxygen by normal persons when performing muscular work. Large doses of the extract were required to produce this effect. The extract, cortin, has been known chiefly for its life-saving power in cases of Addison's disease, in which the cortex of the adrenal glands has been injured or destroyed. Like insulin in diabetes, cortin keeps Addison's disease patients alive by making up for the deficiency of cortin produced by their own sick glands.

SURGEONS who try to relieve extremely high blood pressure by cutting the nerves from the adrenal gland may be on the wrong track, it appears from research reported by Dr. Lester R. Dragstedt, John van Prohaska and Herman Harms, of the University of Chicago. The theory back of these operations is that adrenalin, or epinephrine, as it is also called, in excessive amounts is the cause of the

high blood pressure. Therefore cutting the nerves of the epinephrine-producing adrenal glands should relieve the condition. Testing this theory, epinephrine was given continuously for 15 days to normal dogs. This kept the blood pressure high, but the majority of the animals died, not of the high blood pressure, but with symptoms that suggested disturbance of the digestive tract. Excessive epinephrine, the scientists conclude, may produce a moderately long-continued high blood pressure, but the amount required to give this effect is enough to produce other, usually fatal, effects on the system, which looks as if the operation would be unsuccessful because it is based on a wrong theory of the cause of the condition.

THAT the kind of breathing known as Cheyne-Stokes respiration, characterized by rhythmical variations in intensity and usually seen in coma due to nerve center disease or shortly before death, can be converted to a regular rhythm by improving blood circulation through the brain was reported by Drs. W. D. Paul, James A. Greene and A. E. Feller, of the State University of Iowa. From their results it is suggested that improper circulation of blood to the brain is an important factor in producing periodic breathing.

THE cause of one of the sudden and mysterious diminutions in wild life which disturb naturalists and hunters alike has been found by Drs. R. G. Green and C. L. Larson, of the University of Minnesota and the Bureau of Biological Survey, Minneapolis. Shock disease of wild snowshoe hares is a condition characterized by such low blood sugar level that the animals die within a few hours after the first appearance of symptoms. The condition probably affects the animals much as an overdose of insulin affects a diabetic patient. The disease comes on in 10-year periods, causing a marked reduction in number of the animals. Further study of the hares showed that the cause of the trouble was a degenerative condition of the liver cells.

FROM being known as a single vitamin that prevented a serious nervous disease, beriberi, seen only in Oriental countries, vitamin B has become a complex of many vitamins, some of them still little understood even by scientists who make a special study of the subject. Thirteen reports on different phases of vitamin B were made at the closing session of the meeting. One of the new B vitamins is now named W and another is known as H. There are about 6 that still go by the family name of B, and others which are called flavins. New diseases due to lack of one or another of these B vitamins are also being discovered. One of these, an anemia, was described by Drs. Albert G. Hogan, Luther R. Richardson and Paul E. Johnson, of the University of Missouri.

DR. WILLIAM C. ROSE, of the University of Illinois, reported on the minimum quantity of various essential proteins to normal nutrition. It was found that for every hundred parts of food there must be 0.6 parts of threonine, 0.5 parts of isoleucine, 0.7 parts of phenylalanine, 0.6 parts of methionine, 0.4 parts of histidine and 1 part of lysine.

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SCIENCE NEWS

*Science Service, Washington, D. C.*THE WASHINGTON MEETING OF THE
AMERICAN PHYSICAL SOCIETY

PROFESSOR ARTHUR HAAS, of Vienna, who is now at the University of Notre Dame, advanced a hypothesis to explain the observed red-shift of the light from distant nebulae which has been interpreted as indicating a universe blowing itself apart in expansion. To accept the nebular red-shift as due to expansion from some central point in remote times one has to agree that the limit of the universe is about 500 million light years in distance and that the matter in this expanding world of limited extent is dissolving. Professor Haas's "tired" light hypothesis to explain the red-shift which is observed in the light from distant nebulae suggests that as the little bundles of light energy known as quanta speed to the earth they suffer a loss of energy. In a sense they are like a man running who becomes more and more tired with the loss of energy. This "tiredness" of light quanta means that they have less energy and this in turn is observed as a shifting of the light rays toward the red end of the spectrum. Thus a quantum of violet light has more energy than a quantum of blue light and a change from violet to blue color is a shift toward the red. Actually, the light is not necessarily red in color, as is sometimes erroneously suggested.

PROFESSOR H. P. ROBERTSON, of Princeton University, described calculations on the dynamical effects of the sun's radiation on small pieces of matter up to one or two inches in diameter. These calculations show that the effect of the radiation which a particle of matter might receive from the sun and which is then given off by the particle has the net result of retarding the orbital velocity of the particle about the sun. This slowing down, in turn, has the effect of gradually drawing the particle nearer and nearer to the sun until it is finally drawn into it. Thus solar radiation is an agency for clearing the neighborhood of the sun of small particles by sweeping them into it.

A WAY of seeing in the laboratory what may be happening far down deep in the earth where the enormous pressures change matter into forms of strange characteristics was described by Dr. Robert B. Jacobs, of Harvard University. In his experiments crystals of materials like gold iodide were studied by x-rays while they were subjected to pressures as great as 60,000 pounds to the square inch in special steel chambers. Because the steel would ordinarily mask any possible knowledge of the much more transparent crystals inside, a special window of beryllium was fashioned in the walls of the compression chamber, and through this window the x-ray studies were carried out. The gold iodide crystals at the high pressures were found to have a structure quite similar in design to that of common table salt.

PROFESSOR O. STERN, of the Carnegie Institute of Technology, described an experimental method for the study of one of the basic units of magnetism, the magneton. He suggests that whereas a beam of molecules moving hori-

zontally will gradually fall, due to gravity, like an artillery shell fired level, it is possible with a similar beam of magnetic molecules to suspend them in their flight, by the repulsion of a near-by magnetic field. Professor Stern sends a molecular beam down a tube and beneath the tube he places, parallel, a wire carrying current. The magnetic field of this current is used to balance the fall of the molecules as they go along, and it is possible to determine the current which will just hold the beam in its level line. From this the force of magnetism in a single unit magneton can be calculated.

EVIDENCE that cosmic rays have a small variation in their intensity throughout the day and attain a maximum value at about eleven o'clock in the morning was reported by Dr. S. E. Forbush, of the department of terrestrial magnetism, Carnegie Institution of Washington. The daily, or diurnal, effect is very small but persistent throughout observations carried on continuously for 360 days. It amounts to less than two tenths of one per cent. of the total radiation (.17 per cent.). In general, and except for minor particulars, the findings of Professor V. F. Hess, of Innsbruck, who, in 1936, was awarded the Nobel prize in physics jointly with Dr. Carl Anderson, were confirmed. Professor Hess for some years has been carrying on continuous studies of cosmic ray intensity and has noted a daily shift in the intensity. If these results are quantitatively substantiated by observations made at other stations and are accepted by other investigators, then a satisfactory theory for the cause is required. This requirement may throw some light upon the origin of at least a small part of the radiation in cosmic rays. Further observations are being taken at the magnetic observatory at Huancayo, Peru.

HENRY W. KNERR, of Pennsylvania State College, reported that the continual pushing of the radio wavelengths to shorter and shorter values has now made it possible to investigate the structure of water with radio waves from two to eight inches long. The bending of such short radio waves is much greater in water than is the bending of light waves. The index of refraction is about 1.6 for light and was measured as 8.79 for the radio waves used.

THE fact that a wave of electrical potential has a different speed, depending on whether it is of positive or negative sign, was reported by Professor J. W. Beams and Drs. L. B. Snoddy and J. R. Dietrich, of the University of Virginia. The speed of potential waves in a tube some fifty feet long were measured, even though the waves were traveling about 120,000 miles a second. The negative impulses were found to travel twice as fast as the positive impulses.

ANOTHER element rendered strongly radioactive by atomic bombardment was reported by Dr. Harold W. of the University of California. Significant is the fact that much of the radioactivity comes in the form of gamma radiation such as radium gives off. Titanium was the metal bombarded and the radioactivity is believed



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be caused by the formation of isotopes of titanium and vanadium. One radioactivity decay had a half life of nearly sixteen hours and another of over sixteen days. Dr. Arthur H. Snell, of the same laboratory, also reported bombardment of bromine with deuterons. A radioactive form of this element, which had a half life of 35 hours, was accompanied by the liberation of gamma radiation.

STUDIES on magnetic single crystals of pure iron and a special nickel-iron alloy were described by P. P. Cioffi, H. J. Williams and R. M. Bozorth, of the Bell Telephone Laboratory. Pure iron had a high magnetic permeability of 680,000. The alloy, however, had a permeability of almost twice as much—1,040,000.

PROFESSOR ROBERT VAN DE GRAAFF and Drs. C. M. and L. C. Van Atta reported that the twenty-four foot accelerating tube for the five million volt electric generator of the Massachusetts Institute of Technology at Round Hill, Mass., has been completed and tested. The towering spheres which store up electric voltages in the airship hangar at Round Hill have been completed and tested some time ago, but the use of the equipment for atomic bombardment experiments has been delayed until the accelerating tube was finished. The tube rests, high in the air, on a special I-beam made of bakelite-impregnated plywood. Each of its four sections contains twelve porcelain cylinders and eleven steel electrodes which gradually accelerate the particles passing down their axes from voltages supplied by the collecting spheres at each end. In use the tube is evacuated. Arrangement has been made to focus the beam of charged particles as they speed down the tube to the target so that the beam will not spread out and hit the walls of the tube with destructive effect.

A CASE in which two separated electrical contacts built a metallic bridge between themselves was described by G. L. Pearson, of the Bell Telephone Laboratories. Electrodes of gold, steel and carbon were used in the study, separated by the real but small distance of two millionths of a centimeter. When a potential of about 10 volts was applied on the two contacts, it was found that the electrostatic force created was sufficient to pull the material from the electrodes so that it bridged the gap and allowed the current to flow.

A THEORY of mountain formation in the earth which gives quantitative agreement with the known heights of mountain ranges throughout the world was described by Dr. Ross Gunn, technical adviser of the U. S. Naval Research Laboratory. The theory is an outgrowth of Dr. Gunn's earlier calculations on the side-thrust occurring along the shores of deep oceans like the Pacific. This thrust is probably caused by the uneven density or lopsidedness of the earth. This unequal formation of the earth is explained if one accepts Dr. Gunn's earlier hypothesis that the solar system originated when a huge star split into two parts; one of which became the sun and its associated planets and the other became lost by journey out into space. The planets splitting off from the sun were hotter on one side than on the other, and this temperature difference accounts for the unequal distribution of material on the surface of the earth. Once the uneven distribution is assumed the movements of

earth masses by the varying gravitational pull of the different parts can be used to explain the upthrusting that eventually has created the world's great mountain ranges.

A TINY, compact battery which weighs less than two pounds and yet will deliver 1,000 volts was described by Willis E. Ramsey, of the Bartol Research Foundation of the Franklin Institute. The battery will keep indefinitely when not in use because it is completely dried and sealed in an airtight box. When operation is desired a few drops of ammonium chloride are applied and its high voltage is obtained. After use it is again dried. The original purpose of the equipment was to supply high voltage without undue weight in the cosmic ray measuring apparatus sent aloft on unmanned small balloons by Bartol scientists.

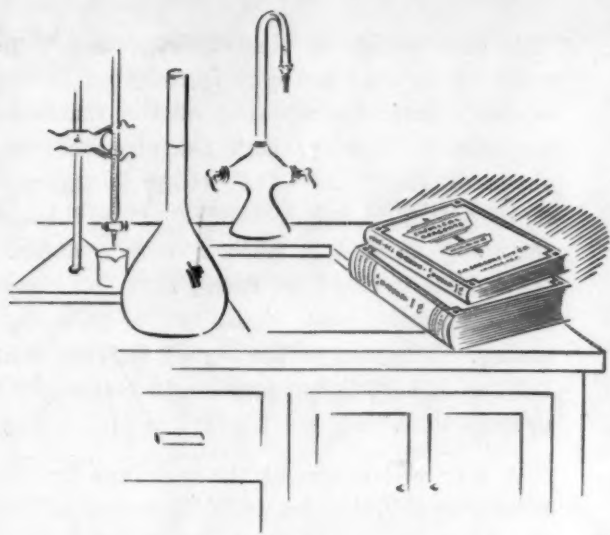
It is proposed to separate isotopes by whirling them in centrifugal force fields of some 10,000 times that of gravity, according to Professor O. Stern, of the Carnegie Institute of Technology. This is done by balancing the effect of the centrifugal force for a given mass by applying an external magnetic field. In this condition molecules slightly heavier gradually seek the outward path while the lighter ones stay in their previous path. A suitably placed collector separates the two isotopes.

A MODEL of the bones in the human ear which transmit the vibrations of the ear drum to the inner ear, where nerves pick up the energy and conduct it to the brain, was discussed by Professor Otto Stuhlman, Jr., of the University of North Carolina. The model studied was an exact copy of the ear bones magnified twenty-four times their natural size. The three bones, malleus, incus and stapes, form a complex system of levers and joints having frictional bearing surfaces that distort the sound waves. Their inward motion is even different from their outward motion. Their action is compared to a radio tube amplifier with a non-symmetrical characteristic. It was shown that part of the beautiful effects of musical tones is due to subjective tones added to the musical tone by the complex motion of these middle ear bones.

THE WASHINGTON MEETING OF THE AMERICAN GEOPHYSICAL UNION

GREATER safety for planes, their pilots and their passengers, is sought in a program of research for small high-flying balloons proposed by Professor Charles F. Brooks, of Harvard University. These small unmanned balloons, carrying featherweight, ultra-shortwave radio sending sets, will soon be ascending in scores and hundreds daily from weather observatories everywhere. They can gather and report weather data at altitudes of 20,000 feet or more, beyond the reach of human fliers except at unjustifiable expense. Professor Brooks laid out a seven-point research program, which he recommended for the adoption of meteorologists interested in upper air phenomena, and which will also have its applications in ground-level weather studies. Among his points are: study of extent, heights, shapes of fogs and cloud masses and their chances of clearing up; types and causes of "rough air"; fronts of contact between warm and cold air masses, with especial attention to lightning and to

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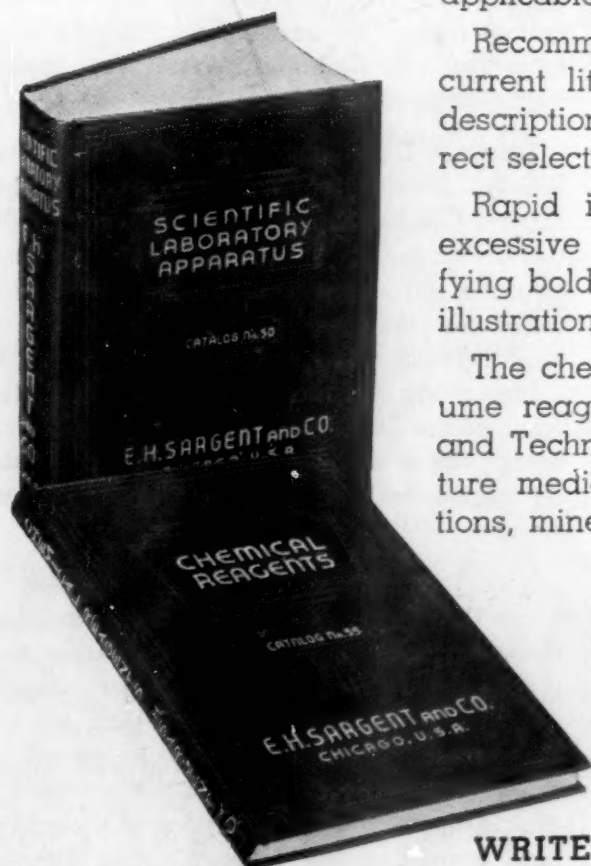
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winds that "go straight up"; ice conditions, their extent and height; high-altitude observations, with a view to better forecasts; hurricanes and typhoons; variations in ultra-shortwave radio transmission in relation to atmospheric stratification and fronts.

DR. H. U. SVERDRUP, director of Scripps Institution of Oceanography, reported a cooperative research program participated in by the institution and the California Fish and Game Commission, which includes the releasing of 6,000 drift bottles at sea. Each bottle contains a paper stating where it was dropped overboard and requesting its return.

QUANTITATIVE measurement of the dim light that fish and seaweed live by is being undertaken with a new instrumental set-up devised by Dr. R. T. Young, of the Worcester Polytechnic Institute. This consists of a water-tight casing containing a photoelectric cell, which can be lowered into the water. At the same time a twin photoelectric cell in the boat registers the surface light. The difference between the two readings, after calibration, shows how much light the water absorbs.

DR. CHARLES G. ABBOT, secretary of the Smithsonian Institution, made a weather forecast in which he said, "We seem justified in expecting a recovery from drought conditions in the Northwest within a year or two, but a severe recurrence of them following the year 1975." This is based on the 23-year cycle in solar activities and weather on the earth. A double period, a cycle of 46 years, appears to be particularly important in precipitation. It seems to have recurred regularly, affecting tree-ring widths . . . for four centuries. Its recurrence is in nearly the same phase as the variations of level of the Great Lakes for the past century. The 23- and 46-year cycles have also appeared in temperature departures from normal in such widely separated regions as western Europe, South Africa and Australia.

How loud is an earthquake? This question was raised by Dr. H. Landsberg, seismologist at the Pennsylvania State College. The noises that accompany earthquakes, often terrifyingly loud and grinding, have never been adequately accounted for. They do not always appear to originate at the point of maximum disturbance, the earthquake's epicenter. It is also difficult to calculate the amount of earthquake energy diverted into the production of noise; calculations made by Dr. Landsberg indicate that only one ten-thousandth of the energy of the shock waves can pass into the air as sound waves. It would be possible to record the energy of the earthquake noises in terms of decibels. However, the necessary sound-recording instruments are unlikely to be available when an earthquake occurs. For this reason, Dr. Landsberg proposed a five-grade comparison scale for auditory comparison: (1) Whisper, or rustling of paper. (2) Conversation, quiet car moving at low speed, slight knocking. (3) Distant thunder, distant artillery fire, distant drums, church bells, rumbling inside slow-moving train. (4) Heavy thunder, noise in slow subway, train in tunnel, avalanche, artillery fire, waterfall. (5) Near-by explosion, quarry blast, noise in airplane, collapse of building.

A NEW device for measuring sky blueness was described by Drs. H. Landsberg and H. Jobbins, of the Pennsylvania State College. It is considered an advance over the series of standard color cards hitherto employed, being more rapid and direct in use and having no abrupt jumps from one degree of blueness to another. The device consists of a wedge of clear blue glass of a standard hue, mounted so that sunlight is reflected through it from a mirror. Half the opening of the frame in which it is mounted is open, so that the observer can look at the sky and then slide the wedge along until the color matches. The deeper the blue, the thicker the part of the wedge needed to make a correct match. In trial observations, it has been found that the bluest part of the sky offers the best visibility; a pale sky means poor seeing. The part of the sky 90 degrees of arc away from the sun and on the opposite side of the sky is usually the deepest blue.

A MAP was shown at the meetings by Drs. Charles W. Brown and Wyndham O. J. Roberts, on which the number of tornadoes during a fifty-year period have been marked and isotorns, lines of equal tornado frequency, have been traced. This was not easy, for some counties are tornadoless islands in the midst of areas of rather high tornado frequency. The map shows that the tradition that all of Kansas and other western states are "cyclone country" is unfounded. The higher, drier parts of the plains have relatively few tornadoes; only when one gets into regions of higher rainfall do the twisters begin to make a formidable showing. Other regions of low tornado frequency are the northern border of the central region, the seaward margin of the coastal plain from Texas to New Jersey, and the Appalachians from hilly Georgia to New England.

DR. CARL I. ASLAKSON, of the U. S. Coast and Geodetic Survey, described an automobile trailer that has been fitted up as a laboratory for the study of differences in the earth's gravity in different localities. Such apparatus as radio, chronograph, amplifiers, chronometer and batteries are permanently installed in it. In studying the local differences in gravitational attraction, the swing of an accurately measured pendulum is automatically clocked against the Arlington radio signals. The pendulum swings faster or slower than "standard" rate, depending on the location and density of major rock masses in its vicinity.

THE REVEREND JAMES B. MACELWANE, S.J., of St. Louis University, spoke on the action and causes of deep focus earthquakes—and of the mystery that still surrounds them. Some of these deep earthquakes occur as much as 700 kilometers, or more than 400 miles, beneath the surface. Yet they seem to be set off in essentially the same way as earthquakes much nearer the "top," that is, by the gradual piling up of a condition of strain until something has to snap. The fact that there is something that far down that can snap appears to be an argument against the old notion that the earth's interior is all a fiery fluid; for fluids can't snap, only solids, or something very nearly solid, can do that.

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SCIENCE NEWS

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NEW ATOMIC PARTICLES

ARE there two new, mysterious atomic particles or building blocks of the universe? Or are the particles, intermediate in weight between electron and proton, discovered at California Institute of Technology and at Harvard the same?

The new form of matter discovered by Dr. Carl D. Anderson and Dr. Seth Neddermeyer, of the California Institute of Technology, came to public notice through a Science Service dispatch last November and a full report will appear shortly.

An unusual penetrating particle in cosmic rays was reported by Drs. J. C. Street and E. C. Stevenson, of Harvard University, to the recent meeting of the American Physical Society in Washington. The Anderson-Neddermeyer particle carries the same amount of electricity as an electron, but both positives and negatives are found. In mass it is intermediate between electron and proton. The Street-Stevenson particle is described as being neither electron nor proton. Both occur in cosmic radiation and the Harvard studies indicate that 80 per cent. of the cosmic rays reaching sea-level are the new particle.

The new particle, or particles, do not fit into present theories. This is an indication of the comparatively poor state of theoretical physics when it comes to explaining the collision of particles at the enormously high energies encountered in cosmic rays. There is now complete agreement that all the evidence points to outer space as the origin of cosmic rays. When these rays strike the upper layers of the earth's atmosphere, there are terrific collisions with the air atoms present. It is generally recognized that perhaps inside the first 10 per cent. of the earth's atmosphere, counting from the top, there is much absorption and that what occurs and is measured on the earth is merely the tremendously complicated debris of a whole series of violent collisions, set off by the primary cosmic rays.

Up to energies of some 400,000,000 electron-volts, workers are fairly confident that their present theories give at least an approximately correct picture of the happenings that occur. But they admit that in the energy range above 400,000,000 the theory is behind experiment. The particle or particles recently reported may represent additional evidence of this fact.

The favored mathematical theory of the moment which was quoted by many of those presenting papers on the cosmic ray is that of Drs. J. F. Carlson and J. R. Oppenheimer, of the University of California. Drs. Carlson and Oppenheimer published their paper "On Multiplicative Showers" on February 15. Their mathematical report is considered one of the best attempts to link the theory and experimental facts in the high energy range encountered in cosmic ray studies.

Drs. Carlson and Oppenheimer pointed out then that quantum theory indicated that for very high energy particles striking the upper atmosphere, for example, it might be possible to have the formation of pairs of par-

ticles and energy losses which would no longer depend on the energy in the incoming radiation. Thus, at least in theory, it might be conceivable that the secondary "débris" produced by either a photon or radiation or by an electron, might be almost as penetrating as the primary effect. In the intricate conglomeration that is observed on earth, the primary energy which came onto the earth from outer space is soon distributed among a large number of electrons and photons. How these so-called "showers" or "bursts" of cosmic rays are developed and the way the showers are absorbed was the detailed function of their report.

While the Carlson-Oppenheimer theory is considered the best of its kind at present no one doubts that it will be extended and perhaps modified in the future. Whether the supposed "new" half-way particle or particles reported will fit into a modified theory is, of course, not yet known and its existence will have to be certified to by much independent work.

THE TOTAL ECLIPSE OF THE SUN

To witness the longest eclipse which has occurred in over 1,200 years astronomers have only two spots in the world where they can do worthwhile scientific work; low-lying islands in the South Seas archipelago that rise only a few feet above high water, or the coast of Peru where observing stations from 3,000 to 10,000 feet altitude offer the best possibilities. Nowhere else in the 8,000-mile-long curving arc which will trace out the shadow cast by the moon on the earth's surface on June 8, is there a firm foundation on which to mount equipment.

The astronomers of the United States are concentrating on two spots. First choice, but difficult to reach, are the Enderbury and Canton islands of the Phoenix group in the South Pacific some 1,800 miles southwest of Hawaii and 3,000 northeast of Australia and just south of the equator. On Enderbury Island the period of total blocking off of the sun's light will last four minutes and 10 seconds. The sun will be nearly 23 degrees high in the sky early in the morning at 7 hours, 42 minutes and 6 seconds in the morning.

Those observing groups not fortunate enough to finance such a distant expedition, and to secure the needed transportation furnished by the Navy, are concentrating on the coast of Peru where, at about 5:10 P.M. local time the sun will be blocked out, for three minutes and 24 seconds. The major potential hindrance with this site is that the sun will set at 5:45 P.M. and thus will be very low in the sky; only some eight degrees above the horizon.

Observations are comparatively difficult at this low altitude for the sun's rays must pass through great lengths of the earth's atmosphere and convection currents in the air, dust and other troubles interfere. However, on June 19, 1936, excellent photographs of the sun's corona were secured at Chios when the sun was only a little over nine degrees above the horizon.

The expedition of the U. S. Navy-National Geographic Society will employ a new device developed by Dr. Irvine

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Gardner, of the National Bureau of Standards, that should obtain better pictures of the far-flung, but faint, streamers which blaze out hundreds of thousands of miles into space from the shining corona of the sun.

Dr. Gardner's device is a rotating disk with four sections cut out of it. This disk spins 100 times a minute in front of his telescopic camera. The amount of light reaching the photographic plates depends on the openings in the disk. Out near the rim the openings are large and nearly all the light will come through. Nearer the center, more and more light is cut off. The object of the device is to secure about equal light from the brilliantly bright part of the corona near the sun's surface and from the very faint outer portions of the corona. Photographs of the corona, in the past, have sometimes been overexposed by the brilliant inner corona before sufficient light from the outer corona was obtained.

On the Peruvian coast, north of Chimbote, at an altitude of 3,000 feet will be another new device being used for the first time in a total eclipse of the sun—the fast Schmidt type camera operated by Professor Charles H. Smiley, director of the Ladd Observatory of Brown University. This small camera will have an optical aperture of $f/1$, which means that the light-collecting mirror of the instrument is equal to its focal length. The best of candid cameras, one can recall, are $f/2$ or $f/1.5$, while most telescope cameras are $f/10$ or more. The lower the aperture the greater the light-gathering power of the instrument and the shorter may be the exposure time. Professor Smiley's Schmidt camera can scan the sky through 20 astronomical degrees, while the ordinary reflector camera can picture only about one degree. The fast light-gathering camera should be useful in recording the relatively poor lighting conditions that will prevail in Peru.—ROBERT D. POTTER.

A FOSSIL PLANT OF THE CAMBRIAN ERA

THE world's oldest land plant, estimated to be about 500,000,000 years old or almost twice as old as previously discovered specimens, has been detected from its fossil remains. The primitive shoot, found in black oil shale from Sweden, is believed to have lived during the Cambrian era, a fact that substantially doubles the known age of higher plant forms on earth. Previous evidence has indicated that plant life first emerged from the water during the uppermost Silurian period or just under 300,000,000 years ago.

Investigators have for some time suspected that land plants probably existed during the earlier Cambrian period from a study of the fossils of animals of that era which must have depended to some extent on plants in their diet. This indirect evidence, however, has never previously been confirmed by discovery of the remains of the plants themselves.

William C. Darrah, instructor in botany and research curator of the Botanical Museum of Harvard University, identified the Cambrian plant by a new process in which a transparent cross-section only one twenty-five-thousandth of an inch thick can be cut from a fossil for microscopic study. While many samples of Cambrian oil shale have been available for study previously, they are so black

that close microscopic study under large magnification has been impossible until the new method was developed.

Examined with the new technique, however, the shale was found to contain minute plant spores, barely visible to the naked eye. Each is marked by a small three-pointed star or tetrad-scar, a characteristic of early growth stages in higher plants but not found in the more primitive water plants. Another characteristic of land plant spores was also detected, their wax coating which wards off water and decay. Because of this coating the spores have been preserved through the ages while the fleshy parts of the early plants have been crushed and destroyed.

RECORDS OF NIGHT WIND VELOCITIES

A PHOTOGRAPHIC method of charting the directions and velocities of night winds high above the earth, a development expected to be of considerable value in weather forecasting and aircraft operation, has been developed in the meteorological laboratory of the Massachusetts Institute of Technology.

The cardinal feature of the method lies in its use of a "whole sky camera," one employing a wide-angle 180-degree lens, and a sounding balloon equipped with flares so attached to an ordinary piece of blasting fuse that they flash at set time intervals. Developed by Athol F. Spilhaus, of the Woods Hole Oceanographic Institution, now conducting research at the Massachusetts Institute of Technology, the new method is expected to permit studies of complicated wind structures not obtainable in greater detail than has heretofore been possible but more accurately and more easily as well.

In operation the camera is set at a chosen observation point with its lens pointing directly overhead. As the balloon ascends the flashes of the magnesium flares, set off at time intervals as small as five seconds if desired, are recorded on the photographic plate. The picture taken by the wide-angle lens is circular, the circumference showing the horizon on all sides. Thus the brilliant magnesium flashes are recorded regardless of what direction the balloon takes. By measuring the resulting angles of elevation and direction between the camera station and the recorded flashes and correlating this data with the rate of the balloon's ascent, a complete and accurate record of wind velocity and direction is easily obtained.

The previous method of charting winds of the upper air has been to release a balloon and to follow its course with a theodolite with which the investigator reads the angles of elevation and direction every half-minute or minute. At night, research workers have hung a paper lantern containing a lighted candle from the balloon and followed this light. The candle is very dim and its light is lost rather quickly. Some have been known to plot the course of stars, thinking they were trailing the lantern.

The Spilhaus method, however, practically eliminates this "human equation" and even the most inexperienced observers can easily make rapid and accurate readings photographically. In preliminary tests the flashes have been recorded at distances as great as seven miles and at heights in excess of 13,000 feet. Meteorologists expect, however, that both this distance and this altitude can be greatly exceeded.

OCCUPATIONAL HAZARDS

LEAD poisoning, and not silicosis or any of the other occupational diseases, is the chief hazard to the health of workers in industry, according to Dr. William D. McNally, Rush Medical College, Chicago, who spoke at the Midwest Conference on Occupational Diseases in Detroit. Wherever dusts are found containing lead, whether it be in mines, smelting, in the manufacture of lead pigments, in the manufacture of storage battery plates, poisoning is certain to result.

Carbon monoxide and fumes from oxides of nitrogen from dynamite explosions were described as other serious industrial health hazards. There are over nine hundred occupations causing injurious effect upon the health of the individuals engaged in them.

Silicosis, caused by inhalation of silica-laden dust, predisposes the lining of the bronchial tubes to attacks of bronchitis. The bronchitis lays a foundation for pneumonia and tuberculosis. Preventive measures must include the examination of every new employee, good ventilation, masks, and the use of wet processes wherever possible. Post-mortem examinations are advocated in all cases of death where the worker had been engaged in a dusty atmosphere, as microscopical and chemical examination of the lungs will definitely prove whether or not the cause in question is one of silicosis.

Carbon monoxide, one of the most important poisons associated with human life and industry, is without doubt the oldest known poison. Wherever gasoline engines are operated, wherever gas heat appliances are used or wherever there is incomplete combustion of any carbonaceous material, this gas is present. The excellent results obtained in the treatment of carbon monoxide by carbon dioxide and oxygen renders all other methods superfluous. The danger of inhaling oxides of nitrogen was emphasized because of their delayed action. A workman may leave his job complaining of only a bronchial irritation after inhaling the fumes of a dynamite explosion. Several hours later, his lungs become edematous and death may occur within 24 hours. Danger in the use of solvents, such as benzol, carbon tetrachloride and trichlorethylene, is not only in industry but in the home as well. Quantities larger than one pint should not be sold to the laity.

ITEMS

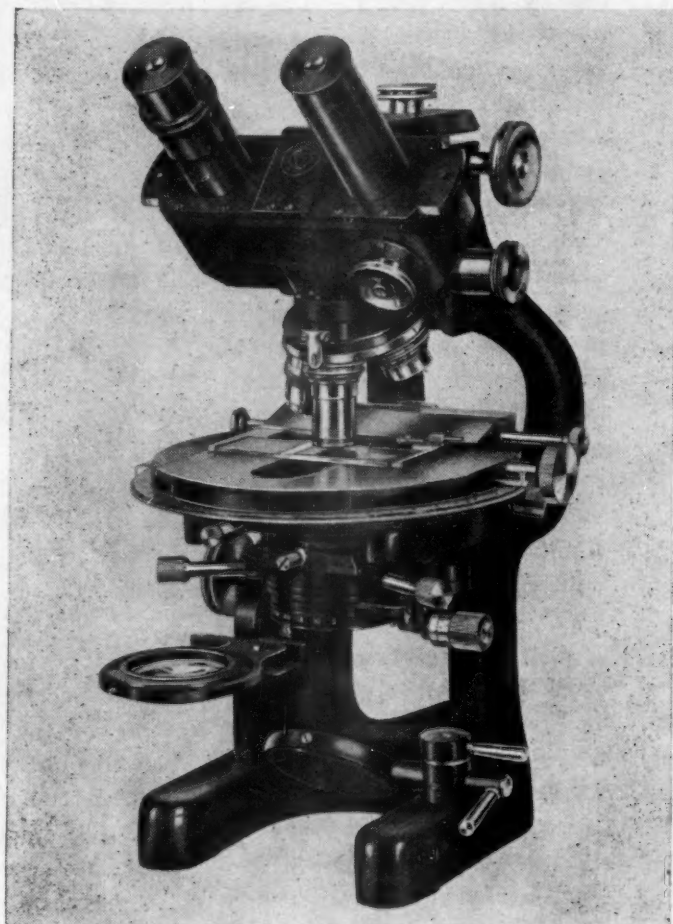
A NEW and better way of making serum to cure pneumonia was described by Dr. Rufus Cole, of the Hospital of the Rockefeller Institute, New York City, at the Conference of State and Provincial Health Authorities of North America, held recently in Washington. Using rabbits instead of horses, two associates of Dr. Cole, Dr. Kenneth Goodner and Frank I. Horsfall, were able to make a serum that is more effective and cheaper to produce. Greater effectiveness results from the fact that the antibody molecules produced in the rabbit's body to fight the pneumonia germs are smaller than the horse's antibodies and consequently spread more rapidly through the tissues infected with pneumonia germs. Fighting pneumonia due to the pneumococcus depends on getting as many of these antibodies into the patient's body as pos-

sible. For this reason Dr. Cole advocates large doses of serum, given as early in the disease as possible.

THAT rats allowed to choose their own food from a variety of substances gained weight more rapidly than other rats fed a diet prescribed by an authority on nutrition was reported to the Memphis meeting of the Federation of American Societies for Experimental Biology by Drs. Curt P. Richter, L. E. Holt, Jr., and Bruno Barelare, of the Johns Hopkins Hospital. The menu from which the rats made their choice was made up of purified casein, olive oil, dextrose, salt, calcium lactate, dry yeast and cod-liver oil. The animals could be divided into two groups, those which selected predominantly olive oil and those which selected predominantly sugar. Both groups, however, showed practically normal activity and sex cycles. When the animals were given their choice of the menu with cod-liver oil omitted, they showed signs of lack of the vitamin A of the oil. When given access to cod-liver oil, they showed a definite appetite for it, resulting in disappearance of the symptoms of lack of vitamin A. The same thing occurred when yeast, source of vitamin B, was omitted and then put back on the menu.

PLACES on earth where the pull of gravity is greater than normal and other places where it is less were among the points discussed at the recent meeting of the American Physical Society by Walter D. Lambert, of the U. S. Coast and Geodetic Survey. Much work has been done recently on the existence of pronounced anomalies under the ocean, particularly in the neighborhood of the great deeps, where mountain ranges could be sunk without a trace. Why positive anomalies, or excess gravitational pull, should exist in the neighborhood of these deeps is still unsolved. There would seem to be a pile-up of denser rock material in these areas. Whether or not such rocks are in the process of slowly "flowing" in the direction of lower density has yet to be determined.

SUCCESSFUL use of sulfanamide and its relative Prontosil, in the treatment of common refractory streptococcus infections, such as childbed fever and infections of the kidney and bladder, was reported by Dr. Russell D. Herrold, of the University of Illinois College of Medicine, at the Chicago meeting of the Society for Experimental Biology and Medicine. This drug would seem to be the first definite advance in the use of chemicals to combat infections since the discovery of the chemical treatment of syphilis. It opens a new field in the fight against infectious diseases. It is startlingly successful, often in as short a time as three days. Its action apparently is somewhat different from that of another useful urinary tract antiseptic, mandelic acid, which has become quite generally used in the past six months. It is destined to almost completely replace the acid. The new compound is much more palatable to the patient. In one tenth of cases, mandelic acid can not be used. The new chemical has revealed no such limitations yet. The chemical is taken by mouth in tablet form and in serious cases is made into a solution for hypodermic injection.



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Contents for June, 1937

No. 1

- M. K. SUBRAMANIAN. Oogenesis of *Meretrix casta* (Chemnitz) with a note on the nature of the contents of neutral red vacuoles. Twenty-five text figures.
- V. NATH. Spermatogenesis of the Prawn, *Palaemon lamarrei*. Three plates.
- D. MUKERJI and M. A. H. BHUYA. Reproductive system of the Bruchid beetles, *Bruchus quadrimaculatus* Fabr., and *Bruchus (Callosobruchus) chinensis* L., (Bruchidae-Coleoptera). Eleven text figures and three plates.
- K. OGUMA. The segmentary structure of the human X-chromosome compared with that of rodents. Six text figures and three plates.
- A. L. GRAFFLIN. Observations upon the agglomerular nature of certain teleostean kidneys. Two plates.
- R. K. ENDERS. Panniculus carnosus and formation of the pouch in Didelphids. Twenty text figures.
- G. MENDOZA. Structural and vascular changes accompanying the resorption of the proctodaeal processes after birth in the embryos of the Goodeidae, a family of viviparous fishes. Four plates.
- R. L. KING and H. W. BEAMS. The effect of ultra-centrifuging on *Paramecium*, with special reference to recovery and macronuclear reorganization. One text figure and two plates.
- R. T. KEMPTON. The dimensions of the renal tubules of *Necturus maculosus*. Two text figures.

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SCIENCE NEWS

Science Service, Washington, D. C.

INSULIN IN THE TREATMENT OF
MENTAL DISEASE

THE accidental discovery of the effect of insulin on the clouded minds of narcotic drug addicts and sufferers from schizophrenia was described by Dr. Manfred Sakel, of Vienna, Austria, at the Pittsburgh meeting of the American Psychiatric Association. This treatment is regarded as almost the first promising weapon of attack on this centuries-old mental disease.

A morphine addict in a Vienna hospital, the story goes, was found to be suffering from diabetes. He was given insulin for this condition. As sometimes happens with insulin treatment, he had an "insulin shock," a state the reverse of diabetes in which the body uses up sugar too fast and the amount of sugar in the blood falls below normal level. When this patient recovered from the insulin shock, his mental condition was greatly improved.

Other patients, who had no diabetes, but were suffering either from drug addiction or from mental disease, were then given large doses of insulin, to induce shock. In many of these, the mental condition also improved, apparently permanently. Similar experiences with the use of this new treatment for schizophrenia were reported by American psychiatrists: Drs. Solomon Katzenelbogen, Herbert Harms and Dean A. Clark, of the Henry Phipps Psychiatric Clinic, Baltimore, and Spring Grove State Hospital, Md.; Drs. Joseph Wortis, Karl M. Bowman and Leo Orenstein, of Bellevue Hospital, New York, and Drs. G. Alexander Young, Richard M. Young and Louis G. Roucek, of Omaha.

From a third to half the patients treated by this method showed improvement in their mental state which appears to be permanent, although the treatment is so new that it is not yet possible to say how long the improvement will last. In some cases it has lasted for three years.

It is apparently agreed that the treatment is most successful in acute cases of schizophrenia in which the patients are young and have not been ill very long. Chronic cases do not seem to respond as well to the treatment. When insulin shock is induced to treat mental disease, the resulting hypoglycemia or sugar lack is checked by giving sugar. The danger of the new treatment is that the sugar may not be given soon enough. The Omaha physicians reported two deaths and two other cases which nearly ended fatally in spite of efforts to bring the sugar level back to normal following the shock.

Since no one knows what causes schizophrenia, no one can yet say why the treatment remedies the condition in certain cases. But the treatment itself may give a clue that will lead to solution of the cause of the disease.—JANE STAFFORD.

RECENT CANCER RESEARCH

A HINT that starch grains injected into cancerous tumors will stop their growth and in many cases cause them to disappear is contained in one of the thirty-three cancer researches in America and abroad supported by the

International Cancer Research Foundation grants amounting to over \$300,000.

This experiment was made on a mouse tumor by Professor Robert Chambers and C. G. Grand, of the Department of Biology of New York University. Injections of starch grains "produced a marked infiltration of polymorphonuclear leucocytes into the tumor." The accumulation of leucocytes inhibited further growth of the tumor and, in many cases, the tumor disappeared completely. Inert particles, like charcoal, did not produce the effect. So far the method has been applied to mice only.

Human cancer cells and tissues have been kept growing for years in glass dishes and fed artificially, according to the report of the Johns Hopkins Cancer Research and Tissue Culture Laboratories. The "J.D." human tumor strain has been maintained in pure and continuous tissue culture for 5½ years and an "A.R." strain has existed for 4 years. A number of human brain tumors had been cultured for almost a year when the report was submitted.

A new theory of cancer formation is suggested by experiments of Dr. A. Haddow, of the University of Edinburgh. Chemicals from coal tars produce certain kinds of cancers and the new idea is that these carcinogenic hydrocarbons actually inhibit growth of the cells instead of stimulating them. The cancer is believed to result from the rise of a new cell race that rebels from the prolonged retardation of the growth of normal cells and multiplies rapidly, forming the cancer.

COSMIC RAY RESEARCH

PROFESSOR J. F. CARLSON and Professor J. R. Oppenheimer, of the University of California, have developed a theory of how the piercing cosmic rays are absorbed when they hit the upper atmosphere and eventually find their way into the recording instruments. A major part of researches on cosmic rays reported at the recent meeting of the American Physical Society in Washington gave the work of Professors Carlson and Oppenheimer as references.

The passage of a cosmic ray through the earth's atmosphere is like the return to earth of a fourth of July starburst, according to the picture which physicists now have in mind. The path of the original ray branches out again and again into an ever-increasing number of new rays called secondaries.

The task of Drs. Carlson and Oppenheimer was to calculate how often this branching-out takes place, how many times it can occur before the energy of the original ray is used up. Physicists want to know this in order that their observations near the earth's surface may tell them how many rays are coming into the atmosphere from outside. According to the calculations, the branching-out occurs when the cosmic ray particle comes very close to the nucleus of an atom in the air. In the intense electric field of the nucleus the cosmic ray particle, electron, generates a powerful kind of x-ray, photon, which in turn when it comes close to another nucleus, is transformed

back into a pair of electrons, charged positive and negative, respectively. The process repeats itself until the energy of the original ray is exhausted.

Another but less frequent kind of branching which Drs. Carlson and Oppenheimer mention in their paper involves the actual destruction of the atom with whose nucleus the cosmic ray collides. This results in a spray of atomic debris and is of the same nature as the transmutations which physicists accomplish with their high voltage atom-splitting machines and cyclotrons.

A current point of discussion is whether calculations like these are valid for the tremendously high cosmic ray energies. The question might be, "Do the high-speed electrons from outer space obey the same laws as the electrons in radio tubes?" The tide seems to be turning in favor of the answer "Yes," according to recent reports.

A NEW RADIO LANDING BEAM

A NEW radio landing beam that emerges from an underground pit and holds great promise for making blind landings of airplanes practical and safe in foggy weather has been described by H. Diamond and F. W. Dunmore, of the National Bureau of Standards. The transmitting antenna is placed in a special subterranean compartment under the center of the landing field instead of being erected dangerously in the air at the edge of the field. The preliminary work was completed and ready to report two years ago, but the interest of another government bureau delayed the scientific announcement. The paper read before the recent joint meeting of the International Scientific Radio Union and the Institute of Radio Engineers was the first public report.

About six years ago the same group of government workers developed a radio beacon system for aircraft landing fields which was so effective that after demonstrations in this country it was adopted and put into extensive use in Europe, Japan and Russia. It has not been installed as regular equipment on American landing fields, however.

The new pit antenna improves this radio landing beam. In the landing system, the airplane glides down a path that is marked by equal strength of radio signal, indicated on a convenient dial on the plane's instrument panel. The way that radio waves travel from the transmitting antenna makes this system possible. One kind of wave goes directly from the antenna to the plane, while another goes from the transmitting antenna to the ground and then is reflected to the plane. The interference of these two waves and decreasing distance combine to allow the plane pilot to steer his craft along a radio path to a safe landing even if he can not see the landing field.

When the transmitting antenna is in the air at the edge of the path of the landing glide was a little too dangerous. Now the pit antenna gives a steeper and more satisfactory approach path. A further advantage of the underground system is that it can be built on a turn-table and swung around to conform to wind direction, thus allowing landings from any direction to be made with the use of only one antenna. Previously several antennae at the edges of the field were necessary. One possibility

is that the whole radio equipment, transmitter as well as antenna, can be put underground at the landing field's center. Two Berlin investigators, Ernst Kramar and C. Lorenz, discussed the principles of blind landing radio system applied in Germany based in part on the earlier American system.—WATSON DAVIS.

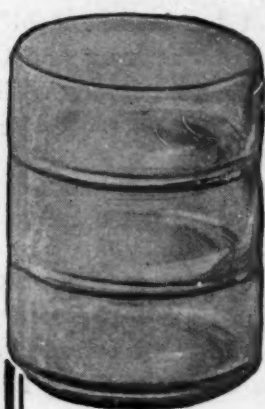
ITEMS

THE planet Mercury has no trace of atmosphere, according to observations of the May 11 transit of Mercury made at the astronomical station of Harvard University, at Bloemfontein, South Africa. A cable reporting fair observing conditions for the infrequently occurring transit was received by Dr. Harlow Shapley, director of Harvard College Observatory, from Dr. John S. Paraskevopoulos. There was no luminous arc around the planet, indicating no air. Best astronomical evidence was that Mercury, like the moon, was completely without air, any that it may have had having escaped into space long ago. But the evidence for the lack on Mercury was less detailed than for the moon.

A SERIES of hundred-million-year-old strata of the Upper Cretaceous, discovered in Utah last summer by government geologists, will be explored for remains of giant reptiles this season by Charles W. Gilmore, of the Smithsonian Institution. It was in the Upper Cretaceous that the dinosaurs, evolved into horned and armored forms, made their last stand against inevitable extinction. A hundred million years ago they ended the domination which they had exercised over the earth for almost that long, and made way for the coming of the Age of Mammals.

THE origin of giant sunflower pictures on southwestern rocks has been explained as a process of erosion by Walter B. Lang, of the U. S. Geological Survey. Mr. Lang solved the puzzle by chemical tests of a typical "sunflower" specimen in the Smithsonian Institution. The giant sunflowers range from about one to two feet in diameter, and are formed on hard sandstone rock. Showers tend to dissolve the binding cement and mineral salts in the sandstone, and in arid climate a small depression in the rock may soon grow into a deep pocket. Such a pocket resembles the disk of a giant sunflower. Rills of rainwater flow in troughs from the pocket outward, forming the rays or petals of the flower.

A NEW type fuel feed system which virtually "shifts gears" when the airplane's altitude changes or when the load on the engine becomes less or greater has been announced by United Air Lines. The twin-engine experimental transport of the company will test the equipment during the coming summer and, if it is found satisfactory, it will be adopted for the company's regular planes. While details of the device are kept secret because of its military value, it is said that the equipment virtually eliminates the conventional aircraft engine carburetor. Greater dependability and freedom from ice formation in the fuel intake systems are claimed for the equipment.



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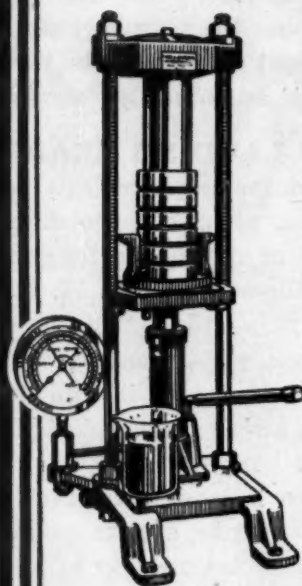
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SCIENCE NEWS

Science Service, Washington, D. C.

THE ATOMIC BOMBARDMENT OF CHLORINE

A NEW transmutation of the elements in which the chlorine atoms are changed first to potassium and then into the inert gas argon has been reported at Princeton University. The transmutation is one of the first achieved with the new cyclotron apparatus now in operation after a year's construction period. Ionized helium atoms are the bombarding source of energy which brings about the elemental change.

Professor Henry D. Smyth, chairman of the physics department, made the announcement of the work of Dr. Milton G. White, Drs. Malcolm C. and William J. Henderson and Dr. Louis N. Ridenour. The form of potassium created lacks one neutron and exists for a brief interval. Its average life is 10.8 minutes. One feature of the cyclotron is that it employs the heavy, electrically-charged helium atoms as bullets to bombard the element chosen as target. Helium gas is passed into a special vacuum chamber, where it collides with a strong electron beam. In the collision the helium atoms lose their outer electrons and become helium ions.

These helium ions, known as alpha particles, are inserted into the intense magnetic field of the cyclotron at its center and go round and round in ever-widening circles for 100 revolutions. At each trip they are accelerated faster and faster by an electric field until they attain velocities of about 15,000 miles a second (about $\frac{1}{10}$ the speed of light) just before they are shot at a target. Bombarding atoms involves a considerable amount of chance, for about 1,000,000 helium bullets must be driven at a chlorine atom before one hit is made. The new form of potassium, created as an intermediate step in the chlorine-argon transmutation, is an isotope of natural potassium. In passing over by spontaneous disintegration into argon it liberates, in the form of fast-moving positrons, energy equivalent to 3,000,000 electron-volts.

Further work on the cyclotron involves the future installation of a 90-kilowatt rectifier which will increase possibly six- or ten-fold the number of alpha particles available and will, it is expected, double their present energy of 8,000,000 electron-volts.

THE PHYSIOLOGICAL ROLE OF ACETYLCHOLINE

SIR HENRY DALE, director of the British National Institute for Medical Research, in his first interview in this country since sharing the Nobel Prize award for this discovery reported that millions of charges of a chemical, acetylcholine, spurt from nerve endings every time a thought commands a muscle to move. He described research leading to the discovery at a medical meeting in Washington which was later reported to the New York Academy of Medicine on May 20.

"When I talk to you," Sir Henry said, "millions of charges of acetylcholine are released to move my tongue and lips." This same chemical is what causes sweat to

stand out on a man's face when he has had a bad fright or other shock. It was formerly thought that this effect was caused by adrenalin, product of the adrenal glands. With the exception of the sweat glands, acetylcholine is concerned only with the nerves that control voluntary muscles and is probably formed at the endings of these nerves. Only an infinitesimal amount is released at each discharge.

Acetylcholine has been known for at least fifty years before its important rôle in the body was discovered. The research leading to this discovery was carried out partly by Sir Henry and partly by Professor Otto Loewi at Graz, Austria, who shared with Sir Henry the Nobel Prize in medicine and physiology for 1936.

Practical application of the discovery is already being made in the case of a serious disease of muscle weakness, myasthenia gravis. The defect in this condition is due either to too little acetylcholine or a too rapid destruction of it, resulting in the inability to use the voluntary muscles. Patients suffering from this disease are now being helped by a medicine which preserves the acetylcholine from too rapid destruction. It is normally broken down into other chemicals after it has performed its function of nerve messenger.

THE ACOUSTIC ALTIMETER

THE acoustic altimeter, an instrument long needed by aircraft, is about ready to leave the research laboratory and go into the hands of manufacturers' designing engineers, according to the opinion of Lieutenant Leo P. Delsasso, U. S. National Reserve.

Lieutenant Delsasso, who is physicist in the University of California at Los Angeles, has been a pioneer in the development of devices for marine depth-sounding and for measuring the height of aircraft from the earth. The several disastrous accidents of recent months have drawn attention to the need of such measurement. While these mishaps are related to different causes they have only too often occurred at moments when the pilots were flying blind, and did not know actual clearances.

Altimeters as now used by airplanes are of the barometric type, and show more or less accurately elevation above sea-level. Unfortunately the distance down to sea-level is of slight importance to a pilot flying through fog over land of unknown altitude. The altimeter of acoustic type as developed by Lieutenant Delsasso depends upon the time taken by sound to travel from a plane to earth and back. Early models tried out in both the Los Angeles and eastern laboratories required such nuisances as ear-phones, great concentration of attention to signals by the pilot, timing and other computations.

The improved model now being tested has an automatic mechanism which translates the complex echo phenomena into a simple movable point of illumination on a dial. Altitude is thus directly and constantly shown. Even the angle of terrain can be determined by a simple mea-

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surement of change of pitch during the round trip of the sound.

The equipment is by no means perfected, however. The present weight of the outfit, about forty pounds, is displeasing to operators of aircraft interested in maximum revenue from cargo transportation. Undoubtedly this figure can be cut to twenty pounds or less. Furthermore, airplanes are so noisy that the acoustic altimeter at present is unable to distinguish differences in height above 700 feet.

New devices for production of special sounds of very high intensity should raise this limit considerably. For low levels, however, the instrument is extremely accurate. This accuracy should be of value to a pilot who is approaching the ground in a dense fog. For example, exact knowledge that the plane is fifty instead of one hundred feet from the ground would facilitate a smooth landing.

SCARCITY OF SALMON IN THE ATLANTIC

SCARCITY of salmon in the Atlantic is probable this year and the next, according to Dr. A. G. Huntsman, of the Biological Board of Canada, who spoke before the Royal Society of Canada at its annual meeting at the University of Toronto.

Dryness and wetness of the summers is linked by Dr. Huntsman to the abundance and scarcity of not only salmon but other forms of wild life as well. There is a periodic recurrence of scarcity every 9.6 years shown in the records of both animals and fish.

Studying salmon statistics Dr. Huntsman came to the conclusion in 1931 that the unknown influence which caused these fish to be scarce every 9 or 10 years must have been acting upon them while they were still small and living in the rivers before going to the sea. The reason for this conclusion is the fact that, in localities where the salmon were the fewest years in the sea before being caught, the scarcity came correspondingly earlier, and where the salmon were longest in the sea, there the scarcity came last.

On a salmon river in Cape Breton, the Margaree, the young salmon were found to be the chief food of the fish-eating birds, kingfishers and mergansers, when rearing their young along the river during the summer. In rainy weather, with the river high and murky, the young salmon are comparatively safe, but in dry summers, with the water low and clear, the birds can remove them very thoroughly. Dry summers should thus be followed by a scarcity of salmon as many years later as the salmon remain in the sea before being caught. If dry summers were responsible for the periodic scarcity of salmon on the average every 9.6 years, they would have to occur the proper number of years before each periodic scarcity.

The last one of these for the Margaree was worst in 1928 and the daily records of river height showed that the summers from 1923 to 1925 were dry, as would be expected from the theory. Records of rainfall, if numerous enough, would give proof of dryness of the summers. Such records as are available do show comparative dryness in the proper years, even back to the seventies of the last century, to explain the most pro-

nounced scarcity of salmon that has been recorded, centered in the year 1880.

There are indications that the wet summers that alternate with the dry ones are likely to be the cause of periodic scarcity of the animals of the interior of the continent, such as rabbits and grouse, by making them more liable to disease. The Hudson's Bay Company kept records of the furs it has taken from the Northwest for more than a hundred years and these show that animals as the rabbit, the lynx, the marten, the fox and others, have been scarce on the average every 9.6 years. Statistics of Canada's fisheries, which have been collected since the Confederation, also show that the salmon of the Maritime Provinces have been more or less scarce on the average every 9.6 years.

THE CALIFORNIA CONDOR

AMERICA'S largest bird, the California condor, is in as immediate danger of extinction as has been thought in the opinion of Arthur Cleveland Bent, ornithologist of Taunton, Mass. Mr. Bent tells the life histories of this and other North American birds of prey in a publication of the U. S. National Museum.

The California condor lives in mountain fastnesses remote from the destructive influences of civilization and it may long continue to exist. There is no doubt, however, that its range, and therefore probably its numbers, have been considerably reduced. It used to be seen northward to the mouth of the Columbia River and eastward into Nevada and New Mexico. Now it is found only in southern California, with a slight eastern extension across the boundary, and in the northern part of Lower California.

The only effective enemy the California condor has had is man. In gold-rush days, miners used to shoot them for their big, hollow quills, which were excellent containers for gold dust. Far larger numbers were killed for no reason at all except the "fun" of shooting something. Now, however, there is a state law protecting them, which seems to have the support of public opinion. They are occasionally still killed, however, when they eat poisoned carcasses that have been set out for coyotes or other predatory mammals.

The California condor is a carrion-eater, being in fact a giant vulture. Its nesting sites are clean, and it bathes in running water. Like many other birds and mammals, the condors are fond of play. Often this takes the form of swooping at each other in the air, with the "attacked" bird trying to dodge—a kind of aerial game of tag. Mated birds display much affection, and spend a good deal of time nibbling at each other and in other kinds of love-making. Captive birds, especially the taken young, nibble at their keeper's coat-buttons and demanding to be petted.

PRESIDENT COMPTON'S ADDRESS AT THE THIRD DEARBORN CONFERENCE OF AGRICULTURE, INDUSTRY AND SCIENCE

SCIENCE has made possible a "new thing under the sun"—the more abundant life generally distributed, with

one man's having to make his gains off another man's. Research in pure science must receive public support if this happy state of things is to be stabilized and extended.

These were the main theses of Dr. Karl T. Compton, president of Massachusetts Institute of Technology, in an address given at the opening session on May 25 of the 16th Dearborn Conference of Agriculture, Industry and Science.

In pre-scientific ages, Dr. Compton pointed out, advanced cultures arose, but their brilliant accomplishments were always based on the exploitation of others. The Israelites gained their Promised Land only by exterminating the Canaanite nations already in possession of it. The Greeks and Romans accomplished their marvels of art and learning, soldiery and law, only because they had slaves in the back of the house to do the hard work.

"But there is something new under the sun," Dr. Compton continued, "in that modern science has given mankind, for the first time in the history of the human race, a way of securing a more abundant life which does not simply consist in taking it away from someone else. Science really creates wealth and opportunity where they did not exist before. Whereas the old order was based on competition, the new order of science makes possible, for the first time, a cooperative creative effort in which everyone is the gainer, and no one the loser."

The speaker took government to task for spending so much time and money on regulatory and restrictive efforts in the field of existing technology and knowledge, and for giving so little support, relatively speaking, to much-needed research for the new. He said: "I have frequently felt discouraged by the apathy, and sometimes almost antagonism which has appeared to exist in high places in respect to this scientific program. To be sure, we realize full well that the distress of unemployment must be relieved, that wealth must be properly regulated and distributed, and that curtailment of production of such things as oil and other commodities may need to be regulated in the public interest. My dissatisfaction is not because these things are being done, but because the other things, so pregnant with possibilities for the future, are neglected to the extent of only half of one per cent. of the budget of our Federal Government, and probably less than this percentage of the active interest of our national leaders. But doubtless I am too impatient and critical. After all, it generally takes a long time and much mental effort to reach conclusions which, after reaching them, seem so obvious that we wonder why there was ever any hesitation. So I believe it will be in this case, for I am perfectly confident that in time the public will really have faith in science as the intelligent basis of adjustment and control of the environment in which we live."

ITEMS

BITUMINOUS coal mines that have long been flooded with water are being rescued by the use of deep well turbine pumps. A. B. Kelly, of Greensburg, Pa., reported recently to the American Mining Congress the first successful freeing of an abandoned coal field by this method. In 46 days, the turbines caused 2,500,000 tons of water

to gush out of flooded mines in Westmoreland County, Pa. This was 53,800 tons a day or 37.5 tons per minute. Similar pumps are about to raise 4,000,000,000 gallons (some 16,000,000 tons) of water from a maximum depth of 450 feet in a submerged field in Fayette County, Pa.

DR. PAUL W. MERRILL, of the Mount Wilson Observatory of the Carnegie Institution of Washington, announced at the Syracuse meeting of the American Association of Variable Star Observers, the discovery of a dozen new spectral lines of the element iron in the light from the variable star R Hydrae. The positions of the observed lines can be calculated on the basis of the supposed structure of the iron atom. Asked how astronomers can accept the assurance that the lines really come from iron, Dr. Merrill said: "Suppose you discover lying in the street a pile of small boards of odd shapes. Taking them into a near-by house, you find that every one fits snugly into a hole in the floor, and that no holes are left over. You would conclude that you knew where the boards came from." In the same way the new-found spectral lines fit into the positions predicted by the theory of the iron atom's structure.

AN effort to approach the tremendous pressures that obtain in the deeper levels of the earth's crust has been made in the physics laboratories of Harvard University. Professor P. W. Bridgman reported to the recent meeting of the American Physical Society on some of the results obtained with metals, minerals and other substances. The pressures used ranged up to 50,000 kilograms per square centimeter—711,166 pounds per square inch. Most materials tested did not break but flowed. They were reduced to a plastic, quasi-liquid condition. Those possessing a crystalline structure, even a very fine crystalline structure, had the crystals broken down and made even smaller. Some materials, however, refuse to flow. These include both crystalline substances like graphite and non-crystalline substances like quartz glass; these held out against the pressure as solids to a certain critical point, then broke. An opposite result was obtained with some other substances which were put in as fine powder and came out as transparent glass-like masses. It was a case of complete welding without an external source of heat.

FOSSIL sea-creatures that have always been regarded as sharks were demoted to the lower position of missing links between the true fishes and more primitive forms like lampreys, by Professor David M. S. Watson, of University College, London, in an address recently given before the New York Academy of Sciences. The extinct shark-like animals, known as acanthodians, were always taken to be primitive sharks because of their general body outline and because such remains of their skeletons as were found appeared to be in general shark-like. However, Professor Watson has found such marked differences in braincase, jaws, gill arches and other structural elements that in his opinion it is evident that they belong to a grade of structure more primitive than, and in a wide sense antecedent to, that of the true fish. He therefore considers them to be a special and separate group of vertebrates, lower than the fishes and intermediate between them and the more primitive lamprey group.

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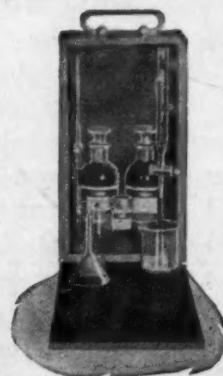
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In the sixth edition of this famous textbook, an attempt has been made to bring the content into accord with the new developments in physical chemistry, to correlate better the existing material, and to raise the standards in keeping with the better preparation which students are now bringing to the study of physical chemistry. The book has been largely rewritten. Many new problems have been added and all have been rearranged into sets.

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SCIENCE NEWS

*Science Service, Washington, D. C.*THE MEETING OF THE ROYAL SOCIETY
OF CANADA

At the Toronto meeting of the Royal Society of Canada, Drs. W. R. Franks and H. J. Creech, of the Banting Institute, reported experimental work in vaccination against cancer. Protection has not been tried in the case of man and will not be until results of animal tests now under way show whether or not the material made in the Banting laboratories is a cancer vaccine. Various proteins have been combined with cancer-producing chemicals such as certain anthracene or coal tar derivatives. This material was injected into rabbits, guinea-pigs and rats. After the injections, the blood of these animals contained antibodies which united with cancer-producing chemicals. Dr. Franks said: "We do not yet know whether the union between the antibody produced in animals and the cancer-producing chemicals checks the power of the latter to cause cancer."

W. H. JOHNSON, of the University of Toronto, told how water fleas, minute marine shrimps, react to light. It is an important practical problem. Young herring, or sardines, feast on water fleas and whether or not sardine cans are to be filled depends upon whether they have plenty to eat. The water fleas go up and down in the water with changing sunlight and moonlight. Why? Moths fly into candles and fish come to the surface when a bright light is flashed. So also water fleas move toward the light when they first come out of the darkness. But Mr. Johnson found that once in the light they may become indifferent, or they may press towards it when it weakens, as if they dreaded losing it, or they may retreat from it when it becomes more intense as if they were afraid of it.

THERE is a chance that practical weed control under field conditions may be achieved by use of relatively small doses of plant poisons, according to a report by Dr. W. H. Cook, of the National Research Council of Canada. Unwanted plants are often reduced to half their usual size by a chemical dose only one tenth that required to kill them.

So alike are the finger and palm prints of so-called "identical" twins that Dr. John W. MacArthur, geneticist at the University of Toronto, reported that this type of twinning can be correctly diagnosed four times out of five from finger and palm prints alone without comparing faces. Using a new method devised by Professor MacArthur, left and right hands of the same person average about 27 per cent. unlike in twins as well as single born. Matching left hand with left and right with right, pairs of identical twins differ by only 19 per cent. in their patterns, lines and ridges. Ordinary brothers and sisters and fraternal twins average twice as unlike or 38 per cent.

LEIF ERICKSON, John Cabot, La Salle, Henry Hudson, Mackenzie and other discoverers of Canada passed in

review when Lawrence J. Burpee made an animated cartoon of Canada's history, done in the mode of Mickey Mouse, part of his presidential address. The importance of Canadian waterways in its discovery and exploration was emphasized by Mr. Burpee. It has been repeatedly proved in practice, he said, that a man might travel in a canoe, with nothing more than an occasional portage, from such a central reservoir as Lake Winnipeg, east to the Atlantic, west to the Pacific, north to the Arctic, northeast to Hudson Bay or south to the Gulf of Mexico.

DR. D. C. ROSE, of the National Research Council of Canada, reported that only thunderheads, technically known as clouds of the cumulo-nimbus type, contain localized electric charges. Airplane flights among the clouds during which delicate potential gradient and conductivity measurements were made furnished this proof of the non-electrical character of ordinary clouds.

DRS. C. D. NIVEN and J. D. Babbitt, of the National Research Council of Canada, spoke of researches on how fabrics transmit heat. They covered a small heated cylinder, representing a person, with underwear, shirting and lined tweed suiting. Then they measured the heat losses in still air and drafts. In absolutely still air the naked cylinder was not protected from heat loss as much relatively as it was in a wind blowing 500 feet per minute. The dressed cylinder in still air lost two thirds the amount of heat which it did when uncovered, but in the wind only a third. The experiments showed the great importance of the air space between clothing and the skin. The apparatus indicates that shirting held away from the cylinder about a quarter of an inch is almost twice as effective in stopping heat loss as shirting close to the cylinder and in the wind of 500 feet per minute about three times as effective. A fabric—either thick tweed or thin cotton shirting—held away from the cylinder about a quarter of an inch allows only about a fourth of the amount of heat to escape in the test wind that the bare cylinder loses, thus confirming the well-known fact that in a breeze there is a considerable difference between wearing the thinnest of cotton shirts and being "stripped to the waist."

TEMPERATURE OF THE SUN'S
ATMOSPHERE

AN unexpectedly large temperature drop of 1,500 degrees Centigrade between the surface of the sun and its overlying atmosphere has been found by astronomers at Harvard University.

Perfection of a comparatively new technique of measuring the heat of the gaseous envelope of the sun, one that employs delicate spectrum analysis, enabled the discovery. With it, the astronomers have calculated the temperature of the sun's atmosphere to be about 4,500 degrees Centigrade. Previous measurements of the heat at the sun's surface have given a figure of 6,000 degrees Centigrade, which, with the new figure for the temperature of the envelope, indicates a falling off of 1,500

Journal of Cellular and Comparative Physiology

Published bimonthly by The Wistar Institute

E. Newton Harvey, Managing Editor, Princeton University

Vol. 10

Contents for June, 1937

No. 1

- W. C. ALLEE and G. EVANS. Further studies on the effect of numbers on the rate of cleavage in eggs of *Arbacia*.
 T. J. B. STIER and J. N. STANNARD. On the mechanism of carbohydrate dissimilation in bakers' yeast. Two text figures.
 E. S. CASTLE. Membrane tension and orientation of structure in the plant cell wall. Two text figures.
 I. R. TAYLOR and F. CRESCITELLI. Measurement of heat production of small organisms. Seven text figures.
 L. V. BECK and A. C. NICHOLS. Action of fluorescent dyes on *Paramecia*, as affected by pH.
 M. H. F. FRIEDMAN. Oesophageal and gastric secretion in the frog. One text figure.
 S. O. MAST and D. M. PACE. The effect of silicon on growth and respiration in *Chilomonas paramecium*. Two text figures.
 H. B. STEINBACH. Potassium in frog skin. One text figure.
 I. W. SIZER. The kinetics of catalyzed sugar hydrolysis as a function of temperature. Four text figures.
 H. HOAGLAND. 'Master reactions' and temperature characteristics.

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degrees. A small temperature drop had been expected, but the large decrease in heat between the sun's surface and its outer atmosphere as shown in the new measurements was not expected.

The research was conducted by Professor Donald H. Menzel, Leo Goldberg, Bemis fellow of the Harvard Observatory, and James G. Baker, a graduate student in astronomy. In the project the black lines found across the ordinary solar spectrum were used. These lines are formed as the sun's light passes through the solar gas envelope with each atom in this atmosphere absorbing its own characteristic colors from the sunlight. The result consists of periodic dark shadows across the familiar rainbow band. Inasmuch as the intensities of these shadows or lines depend to a large degree on the relative heat of the light source, they can be used as a "thermometer" or guide to the temperature of the source.

This relatively new type of research was begun several years ago when Mr. Goldberg undertook calculations of the theoretical intensities of related lines in the spectra of various elements. Dr. Menzel extended this quantitative theory of line formation and more recently applied the research as a key to solar temperatures.

A NEW HIGH-VOLTAGE ELECTROSTATIC GENERATOR

SHOWERS of electrically charged man-made raindrops are the basic factor in the newest high-voltage electrostatic generator just patented by Clarence W. Hansell, of Port Jefferson, N. Y. In this respect the high voltage is obtained in quite the same way—but under controlled conditions of course—in which nature builds up the voltage of enormous potential seen in lightning. The Radio Corporation of America has been assigned the patent rights to the invention. The equipment is designed either for experimental research in bombarding the atom's nucleus or, more practically, as the source of potential on super x-ray tubes for treating malignant diseases, like cancer.

The "rain" consists of a spray of some semi-conducting liquid like water which falls through an intense electric field. Electrical charges are thus carried to the "ground" below, which is a container attached to the generator of high voltage. The little electrical charges on the raindrops are conducted off to the great storage spheres which can serve as the ends of the auxiliary accelerating apparatus.

The important feature of the new invention is its extreme simplicity and absence of moving parts. Most of the electrostatic generators to-day, including the giant of them all at the laboratories of Professor Robert Van de Graaff, of the Massachusetts Institute of Technology, use silk or paper belts to carry up to the storage spheres the small charges of electricity which ultimately attain a potential of as much as 5,000,000 volts. In the Hansell patented generator the falling "raindrops" replace the belts; belts which have caused much annoyance because of their relatively short-lived wearing characteristics.

MOLDED PLASTIC LENSES

SPECTACLE lenses produced at a rate of 1,500 an hour instead of being ground slowly and laboriously by hand,

are only one possibility of the new transparent resin molded lenses now being exhibited in America by two British inventors. Eye glasses for all who need them at a cost measurable in cents instead of tens or twenties of dollars may some day be the result of thus achieving a long-held dream of molding optical lenses instead of fashioning them tediously by hand. Good quality lenses on low price cameras and binoculars are another possibility already realized on a small scale.

In America, in England and in other countries plastics of remarkable water-clear transparency have been achieved. Now from England come lenses of a transparent plastic known abroad as Perspex. And from it are molded lenses accurate enough for almost any use except in the finest of optical instruments. Particularly to the point, the accuracy of the lenses is more than sufficient for spectacles.

The transparent resins have one natural disadvantage compared with glass for the production of lenses. They scratch relatively easily and probably have nowhere near the lasting qualities of glass. The molded lenses rest on two things: the new transparent plastics and the new molding process for fashioning them accurately into a lens surface. It is the second factor which is credited to the two co-inventors from Great Britain: Arthur W. Kingston, research engineer, and Peter Koch de Gooreynd, Anglo-Belgian industrialist. In recent months of the five-year development program Dr. W. E. Williams, of the Wheatstone Laboratory, King's College, University of London, has acted as consultant.

The accuracy of molding in the new plastic lenses is reported to be 1/500,000th of an inch, by independent and reputable measurement. This is sufficient for any but the finest and most expensive of optical instruments. In fact, it is much better than the accuracy required for spectacle lenses, which is 1/500,000th of an inch.

F. Twyman, managing director of the house of Adam Hilger, Ltd., in a report on the new lenses, said that "The lenses submitted to me are satisfactory for the cheap class of work for which they are intended. Further, I am of the opinion as a result of the tests made, that with care in preparation of the material and molding, lenses could be produced of a quality good enough even for such work as good camera lenses, binocular lenses and so forth. The only defects of the material for such work as mentioned above are the obvious ones that it is not so hard as glass, and is thus more easily scratched and that it becomes plastic at temperatures much above normal, being easily molded at 100 degrees centigrade."

The chemical name of the British resin employed in the lenses is methyl-methacrylate. There are equivalent resins known by different trade names, produced by the du Pont Company of America and other countries. The molding process is controlled by the Combined Optical Industries, Ltd.—ROBERT D. POTTER.

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Symposium sponsored by the Section on Medical Sciences of the American Association for the Advancement of Science at Atlantic City, N. J., December 29, 1936, to January 1, 1937

Published under the direction of the following committee of prominent workers in medical science: William Charles White, *Chairman*; Vincent du Vigneaud, C. C. Little, Esmond R. Long, and Carl Voegtlin. Edited by Henry B. Ward.

The papers of this symposium bring out the advances recently made in cancer research by leading investigators along the three main approaches to the problem; namely, biology, chemistry, and physics. This monograph represents an authoritative survey of the subject. A brief summary of the papers will be found in *Science* for February 5, 1937, page 156.

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The first effort was in the direction of navigation of the vast Siberian coast—the Northeast Passage dreamed of since Columbus and Magellan, but never achieved as a commercial possibility. Navigation in turn demanded more exact knowledge of the coasts and waters, and the weather that ruled over the region. So the scientific authorities of the USSR brought about the establishment of some 60 Arctic stations along the coast and on offshore islands. At each of these stations are investigators who study air and ocean conditions, a radio operator and one or more airplanes.

The data are relayed to Moscow for compilation and interpretation through the key radio station on Dickinson Island. When ships come, with a giant icebreaker leading when necessary, the planes go up, spy out the open lanes or the weak places in the ice, and radio navigational information to the ships' commanders. Life at one of these stations is more or less like what it will be for the four Russians who are undertaking a year's residence at the Pole. The houses, however, are very solidly built of timber and are more commodious than the lightweight movable shelter.

At some of these threescore Arctic stations vegetables are grown under artificial light in fur-lined cellars, with current generated by windmill power overhead. No one pretends that they are economically produced, but the workers must have vitamins and some salad. These investigators have been gathering meteorological information that should prove to be of great usefulness in the new program of the study of the weather by air-mass analysis. To the fruits of their labors will now be added data from the Pole itself, which should help meteorologists not only in Russia but all over the earth.

BROADCASTS OF THE ECLIPSE

DESCRIPTION of the longest solar eclipse in more than 1,200 years, which occurs on June 8, lasting over seven minutes at the point of maximum duration, is being brought to America in broadcasts by the two major broadcasting companies. Because it occurs in distant isolated places, programs prior to the great astronomical event have also been given. Those from the eclipse headquarters of the scientific expeditions describe life in these out-of-the-way places in the South Seas and Peru, while programs originating in America are given for the benefit of members of the expedition. The remaining programs follow:

- June 7, 6:45 P.M., E.S.T.—Description of last-minute preparations from Canton Island. (NBC—Blue Network.)
- June 7, 5:00 P.M., E.S.T.—Preview of last-minute technical preparations. (Peru, CBS.)
- June 8, 12:00 M., E.S.T.—Early stages of eclipse from Canton Island. (NBC—Blue Network.)
- June 8, 5:00 P.M., E.S.T.—Description of eclipse. (Peru, CBS.)
- June 8, 2:00 P.M., E.S.T.—Totality described from Canton Island. (NBC—Blue Network.)
- June 8, 9:45 P.M., E.S.T.—Scientists at Canton Island will speak of results of observations. (NBC—Red Network.)

ITEMS

MUCH of the light from the familiar red star Betelgeuse, in the constellation of Orion, comes from its depths not its surface. Dr. Walter S. Adams, director of the Mount Wilson Observatory in California, discovered new features of the star's spectrum photographed with a powerful spectrograph attached to the Mount Wilson 100-inch telescope. Dark lines of the spectrum appeared to be doubled, due to a narrow bright line in the middle of those dark spaces caused by light absorption in the star's atmosphere. This reversal showed that much of the star's light came from great depths within it. The density of the giant red star is only about a thousandth part that of air. This previously established fact is supported by the new researches.

Two thousand feet of 35 mm motion pictures have been taken at the Mount Wilson Observatory in the study of explosions on the sun and the effect of these eruptions upon short-wave radio broadcasts. Dr. R. S. Richardson, of Mount Wilson, has secured considerable evidence to indicate that a strong relation exists between the eruption and radio fadeouts. The motion picture camera is started soon after sunrise and operates continuously with very little attention until shut off an hour before sunset. As a result, a nearly complete record of the appearance of the sun has been obtained since May, 1936. In discussing fifteen eruptions, Dr. Richardson reported that in five cases the time the eruption was first seen agrees to a minute or less with the time when the radio fadeout began. Solar observations were made shortly before the fadeout occurred, the longest interval being eleven minutes. Six of the eruptions apparently preceded the fade-out from two to twelve minutes. For the four remaining fade-outs, the observations were made from ten to thirty minutes after the radio disturbance began.

A NEW machine that may play a great part in the battle against soil erosion is described in a patent recently granted to Edgar V. Collins, Ames, Iowa. The patent has been assigned to the Iowa State College Alumni Association, Inc. It is claimed that the machine will throw soil in the rough 10 miles of erosion-checking terraces in an hour. The usual method of checking soil erosion on sloping ground is to build up parallel rows of terraces that block the rush of water down the slope, trapping it so that it will be absorbed in the soil where it will do most good. At present, plows, scrapers and grading machines are used. But these machines do not work efficiently under adverse soil conditions, and are expensive to operate. Mr. Collins's machine, an ingenious combination of plow and dirt thrower, on the other hand, is simple and speedy and will work anywhere that a plow will work. It is powered by a shaft from the tractor that pulls it. The plowshare cuts a furrow and feeds the soil to a dirt thrower which consists of rapidly revolving screw-like blades. The spinning blades hurl the soil up and out a few feet or more and pile it neatly in a ridge. A standard automobile gear shift controls the revolving speed of the blades to throw the soil to any desired distance.

Three Important New Books

Emmons—Gold Deposits of the World

By W. H. EMMONS, University of Minnesota. 552 pages, \$6.00

This new book includes brief descriptions of all of the world's chief gold mining regions and of most of the lesser ones. About 500 maps and geological cross sections are presented. These show in general the intrusives with which the lodes are associated, the rocks older than the intrusives, and the rocks younger than the intrusives. The principal gold deposits are located on these maps. By illustrating the positions of known gold deposits with respect to intrusives rocks, it is believed that the prospector may be aided in his search for undiscovered deposits. All the material in the book is entirely up-to-date and much of it has not heretofore been published.

Trewartha's—An Introduction to Weather and Climate

By GLENN T. TREWARTHA, University of Wisconsin. *McGraw-Hill Series in Geography*. 360 pages, \$3.00

The purpose of this book is to meet the need for a brief introductory text covering the field of weather and climate. It is written from a climatic rather than a meteorological point of view and is designed to provide an outline for a general introductory course on the atmosphere. A distinctive feature of the book is the fact that it combines in one volume the physical and regional elements of climate. Another feature is the recognition made of the new methods of weather analysis by air-mass methods. The inclusion of bibliographic outlines at the end of each chapter in Part I is also noteworthy.

The Measurement of Radiant Energy

Edited by W. E. FORSYTHE, Incandescent Lamp Department, General Electric Company. 436 pages, \$5.00

This important new book is published under the sponsorship of the National Research Council. In the volume twenty-one specialists, each an expert in his particular field, discuss the fundamental concepts of radiation and radiation laws and explain their action and use. Types of sources, methods of operation and their radiation characteristics are given; the various methods of analyzing the radiation into wavelength intervals suitable for measuring are described; the use of non-selective measuring instruments which includes bolometers, radiometers, and thermopiles are dealt with in detail. There are also thorough treatments of the selective measuring devices which include photographic methods, photoelectric cell and photronic cells.

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SCIENCE NEWS

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THE ANNUAL MEETING OF THE AMERICAN MEDICAL ASSOCIATION

THE importance to the public of medical education was stressed by two presidents of the American Medical Association at its annual meeting held in Atlantic City during the past week. Dr. Charles Gordon Heyd, New York, president of the association during the past year, stated that "The quality of medical services depends on medical education." "Our best argument against the establishment of foreign schemes of socialized medicine is continued maintenance of the high plane of medical practice in this country," said Dr. J. H. J. Upham, Columbus, Ohio, who was installed at the meeting as president for the coming year. The messages of these two medical leaders was that the most important way to provide adequate medical care for the public is for physicians to keep themselves posted on latest medical discoveries and to be prepared to apply them in treating their patients. Three ways of doing this were outlined by Dr. Upham. These are constant improvement of the training of young doctors in medical schools and hospitals; meetings of doctors and medical scientists, such as the present meeting, and the other hundreds of medical meetings held every year in the United States, and postgraduate courses for practicing physicians, especially those far from medical centers. Dr. Upham suggested the establishment of required periodic examinations every 5 or 10 years to determine which physicians had kept up with advances in medical knowledge and were therefore entitled to have their licenses to practice renewed.

DR. HEYD stated that the doctor of the future will need to be well educated and in close personal touch with his patients because he will be treating entirely different kinds of ailments. The day of mass methods in medicine, by which diseases like typhoid fever, diphtheria, syphilis and malaria can be controlled, is going out. With these old plagues under control, and with more and more of the population in the older age brackets, the important diseases of the future will be the degenerative diseases of old age, such as heart and kidney disease, cancer, pneumonia and apoplexy. "Medical practice," Dr. Heyd said, "will require a more personal service, a more extensive control, and, I believe, will require physicians." Dr. Heyd said it is a fallacy to assume "that all people at all times under all conditions can receive what is so glibly spoken of as 'adequate medical service' or even as 'the best of medical care.' It is impossible to make people of ordinary average intelligence look after themselves. It is notorious that there is more delayed medical attention among employees and non-professional staffs of hospitals than those outside the hospital field. The final analysis of the social intelligence of a people will rest on their health program. Wherever we survey a typical death-producing disease and its effect on the community, we find that the record of the United States is superior to that in countries with either a socialized medical system or compulsory health insurance. The final appraisal of our national well-being will rest on mortality statistics."

DR. ALPHONSE R. DOCHEZ, of New York, reported that progress is being made in the attack on the common cold and influenza. The virus which causes the common cold can now be produced and preserved in unlimited amounts. This made possible attempts at vaccinating against the ailment. These vaccinations failed to protect the subjects from colds, for some unknown reason. Further modification of the technique should result in success. Attempts to establish immunity against influenza by similar methods have been somewhat more successful, Dr. Dochez said, referring to previous reports of this research. It is obvious, he concluded, that the problems studied are as yet remote from practical solution. Nevertheless, it seems fair to assert that a certain amount of progress has been made—that light has been shed on complex mechanisms and that methods have been developed which may have future value.

DR. WILLIAM J. EZICKSON AND JACOB B. FELDMAN, of Philadelphia, reported that kidney stones and lack of vitamin A in the diet go together, but the lack of the vitamin is apparently not the cause of the kidney condition. The trouble seems to be that the patient eats enough of the vitamin but for some reason his body can not assimilate it, and it is possible that this same defect of assimilation has something to do with the formation of kidney stones.

DR. EDMUND P. FOWLER, New York, reported that loud sounds are better than faint ones for detecting and measuring degrees of deafness. One reason is that the ear is accustomed to listen to fairly loud sounds, in fact must listen, while faint sounds are usually ignored. There is a greater sensation of loudness in the deafened ear than has been suspected. This is why persons with noticeable loss of hearing for faint or distant sounds can hear conversation at close range as well as those with normal hearing. Dr. Fowler explained that faint sounds stimulate only a few of the nerve fibers that carry impulses to the central nervous system through which we hear. Moreover, if the stimulus is weak, the impulses are weak and slow. With an increase in the stimulus, as in loud noises, both the number of fibers acting and the frequency of the impulses are increased and the nervous system receives a greater number of impulses per unit of time. In spite of defects in the nerve mechanism, the deaf ear sends almost as many impulses to the brain as does the good ear. This phenomenon is of particular value in differentiating nerve deafness from other types. It is also an aid in prescribing hearing aids for those having this kind of deafness.

A NEW way of taking x-ray pictures, which will give a more accurate picture of the interior of the body than heretofore, was shown by Dr. Robert H. Millwee, of Dallas, Texas. Instead of letting the x-rays spread out from a central point, Dr. Millwee has developed a method of taking x-ray pictures with a sheet of rays all in line. Roentgen slit scanography is the name given the new method. Developed in order to get pictures of the

picture free from the distortions of the usual x-ray pictures, Dr. Millwee has found that this method gives a new view of the heart which may be useful in detecting early signs of one kind of heart disease.

A NEW hormone, lipocaic, which is a sort of twin sister to insulin, was described by its discoverers, Drs. Lester R. Dragstedt and John Van Prohaska, of the University of Chicago. Like insulin, lipocaic comes from the pancreas and, like insulin, it is indispensable for life. But where insulin controls the body's use of sugar, lipocaic apparently controls the use of fat. Judging from its effects on animals, it may prove a useful supplement to insulin in the treatment of diabetes.

NEW slow-action insulins have been compared with standard insulin and crystalline insulin in research by Drs. Hugo Freund, of Harper Hospital, Detroit, and Samuel S. Altschuler, of Eloise, Mich., who reported their findings at the meeting.

ULTRA-VIOLET rays from the sun have been used to sterilize the air of operating rooms and are suggested as a way to prevent the common cold, since experiments at the Harvard School of Public Health have shown that these rays can kill the cold germs growing in a special tank. Demonstrations of these researches by Dr. Deryl Hart, Duke University, and Drs. W. F. Wells and Mildred Weeks Wells, of Harvard University, were given.

THAT teeth, like trees, have rings which show the processes of growth and the health experiences of their possessors has been found by Dr. Isaac Schour, of the University of Illinois. He showed these microscopically fine markings, including the one made at birth and called the birth ring.

THE discovery that jaundice temporarily checks the progress of chronic deforming arthritis, suggests that this most crippling and disabling of all forms of chronic rheumatism can no longer be regarded as a relentlessly progressive, uncontrollable disease for which no really satisfactory remedy need be expected, according to Dr. Philip S. Hench, of the Mayo Clinic, Rochester, Minn., who spoke to the American Association for the Study and Control of Rheumatic Diseases, meeting with the American Medical Association.

GROUP hospital insurance, now in effect in many parts of the country, as a first step toward state medicine, was discussed at the opening of the meetings. The warning appeared in a report by the bureau of medical economics of the association, which has been studying this and related problems. The danger, according to the report, lies in the fact that hospital contracts under these insurance plans can not be limited to essential hospital services but must include medical services, such as anesthesia, clinical laboratory diagnostic tests, x-rays and radium treatments and physical therapy. While the general public may not see danger in state medicine, the report points out two other dangers in group hospital plans that are easily seen to concern the man in the street. One is that group hospitalization is actually a form of insurance coverage, "yet actuarial data on which to base

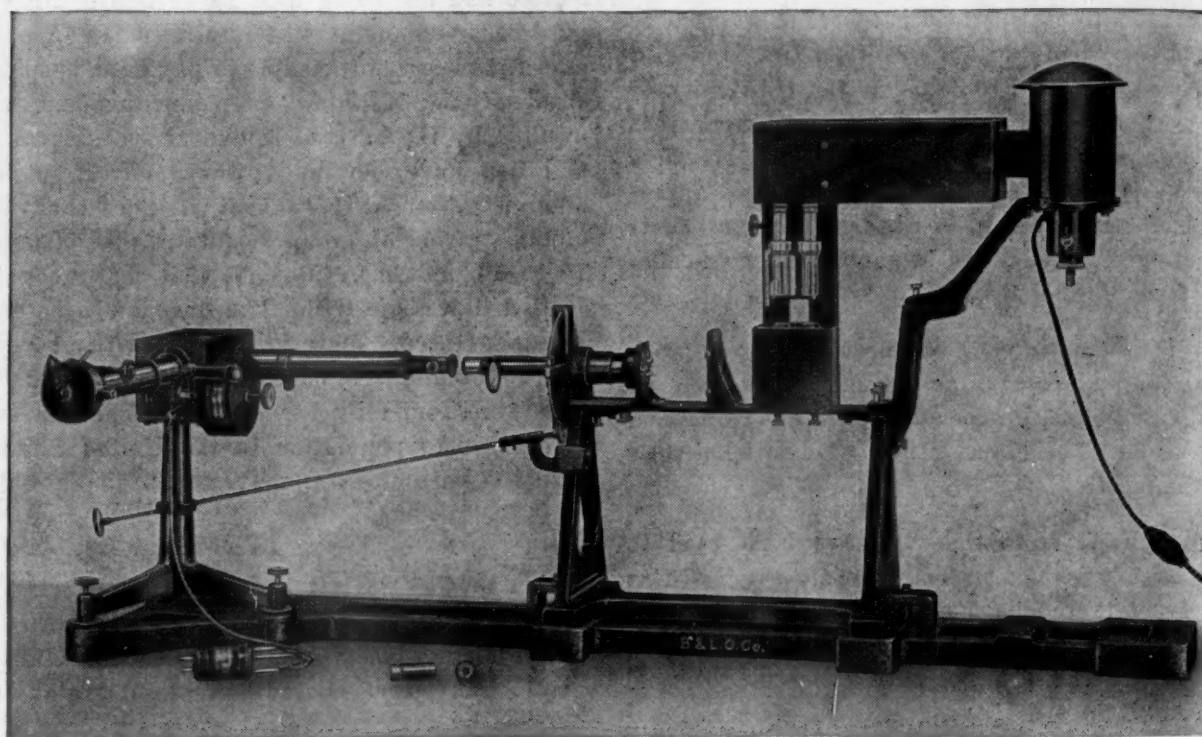
sound premium rates are not available." The second danger is that group hospitalization plans are getting away from the original altruistic purpose of assisting persons of limited means to secure necessary hospital service and are being used as devices to fill vacant hospital beds and augment hospital income. A post-payment plan for those really unable to pay their hospital bills, instead of the insurance prepayment plans, was recommended by the bureau. Medical societies in some communities have developed this kind of plan with an administration cost of about 10 per cent., whereas the administration of group hospitalization plans costs from 12 to 40 per cent. Reports that many counties in the United States are without medical service were found to be exaggerated. Only 19 counties without any physician and in each of 233 one doctor to every 2,000 population were found by the bureau. The general ratio of physicians to population in the United States is about 1 to 750 persons.—JANE STAFFORD.

ITEMS

ONE of the greatest hoards of prehistoric Indian corn ever found in the Mississippi Valley is reported by Robert McCormick Adams, excavating an old Indian settlement at Wickliffe, Ky. Several thousand grains of the corn, charred by fire, were found under the floor of an Indian building near the fireplace. Fire, which wrecked the whole structure, may explain why the Indian store of food was never eaten. Skeletal remains of Indians who lived at the prehistoric settlement are also coming to light in the excavations.

So cat-like was an early sabertooth animal that only an examination of the internal tooth structure proved it to be a counterfeit cat. Professor William Berryman Scott, of Princeton, has given it a name from the Greek, which means just that: "apat," meaning false or counterfeit, and "aelurus," meaning cat, combine into *Apataelurus*. The creature, which lived in early Eocene time, belonged to the animal group known as creodonts, a primitive, quite generalized carnivorous type. One line of descent of these creodonts independently acquired the characteristics of the true sabertooth tiger. The fossil on which Dr. Scott's identification was based was found in Utah by J. Leroy Kay, of the Carnegie Museum, Pittsburgh. In recognition of this, Dr. Scott has given it the specific name *kayi*, so that its whole name is *Apataelurus kayi*.

POSSIBILITY of conquering gonorrhea by a new chemical treatment appears in the report of Drs. John E. Dees and J. A. C. Colston, of the Johns Hopkins Hospital, Baltimore, to the American Medical Association. Sixteen out of nineteen patients were cured by treatment with sulfanilamide. In all but two of these recovery occurred within less than a week. The treatment is still in the experimental stage, but the results obtained together with the reduction in hospital expenses for previously used methods of treating this wide-spread condition are impressive. Careful use of sulfanilamine in clinics where large numbers of gonorrhea patients can be closely watched so that accurate evaluation of the treatment can be made is recommended.



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Two of the leading authorities on plant hormones have brought together and explained experimental work on all aspects of phytohormones. Much of this work, especially that on experimental techniques, is published here for the first time. (Experimental Biology Monographs.) *To be published in August.*

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SCIENCE NEWS

Science Service, Washington, D. C.

POWER FROM THE NUCLEUS OF THE ATOM

WHILE science sees no immediate way in which power directly from the atom nucleus can be turned to useful and practical purposes it is "probable" that applications of existing knowledge to this goal will come within the lifetime of persons now living. This prediction, with its startling implications, was made by Professor E. O. Lawrence, of the University of California, in the commencement address of the Stevens Institute of Technology. Professor Lawrence has the world's most powerful atom-smashing cyclotron equipment in his radiation laboratory, and he and his students have transmuted most of the chemical elements known to man from one form to another. He said:

"But whether it will be possible to release subatomic energy on a practical and profitable basis for industrial purposes, whether perhaps it will be possible to realize conditions on this earth similar to those in the sun, is the question which of course interests the engineer. Indeed, it is a question of interest to every one and accordingly it has been the subject of much popular discussion and speculation. But speculation is hardly more than a game of fortune-telling and this is out of place here. It is only of interest to indicate the present state of knowledge with proper humility, with recognition that what the future holds forth only the future can tell. In this spirit I would say at this time that although we now know that matter can be converted into energy, we do not see any greater prospect of destroying nuclear matter for power purposes than of cooling the ocean to freezing temperatures and converting the heat released into profitable work. It does seem that the same considerations of the second law of thermodynamics govern the availability of energy in the hearts of atoms as in the Atlantic Ocean itself.

"Although I can not encourage the view that some day you will be running power plants by the release of subatomic energy, that you will be using the nuclei of atoms as fuel, I do not wish to emphasize that the establishment of the great principle of the equivalence of mass and energy is none the less of great practical importance. It is probable that in your lifetime and in mine this great principle will play a vital rôle in technical developments which you and I at the moment are not even dreaming of—for such has been the history of science."

THE FOURTEENTH ANNUAL COLLOID SYMPOSIUM

At the fourteenth Annual Colloid Symposium of the American Chemical Society, held at the University of Minnesota, studies reported by Professor Ernst A. Hauser, H. E. Edgerton and W. B. Tucker, of the Massachusetts Institute of Technology, with a high-speed camera, showed that the basis of better cleaning with a weak soap solution rather than a strong solution is the formation of drops of a liquid and the accompanying phenomenon of surface tension. Ingenious silhouette pictures of falling

drops were shown which reveal facts having application in dyeing, tanning and other practical matters besides the washing behavior of soap in solution.

A tiny drum whirling in egg albumin is one of the new techniques used to measure the thickness of protein films, such as constitute the walls of the cells of living matter. Films only 86 billionths of a centimeter thick can be measured, according to the report of Dr. Henry B. Bull, of the Northwestern University Medical School. The drum, of exactly known dimensions, builds up a film at a known rate. The volume of protein film is calculated and divided by the total area of the drum to obtain the thickness of the film.

Drs. Arthur H. Sanford and Douglas B. Roxburgh, of the Mayo Clinic, stated that while it has been known that the proteins in the cerebro-spinal fluid reacted with colloidal gold solutions to cause a precipitation, the fundamental basis for this diagnostic reaction was unknown. The Mayo studies with synthetic spinal fluids that were pure and made from the three proteins in the spinal fluid (albumin, pseudoglobulin and euglobulin) gave the same color reactions as did natural spinal fluid. With the synthetic spinal fluids Drs. Sanford and Roxburgh were able to show that the diagnosis for mental disease by the gold colloid method depended on the delicate balance in the proportions of the spinal proteins present. Any increase in these, or in their various proportions that may accompany the disease shows up in the change in color reaction.

THE ST. LOUIS MEETING OF THE SEISMOLOGICAL SOCIETY OF AMERICA

WILL the 41,518,125,000 tons of water backed up in Lake Mead by Boulder Dam cause earthquakes? The question was raised before a meeting in St. Louis of the Seismological Society of America by R. R. Bodle, of the U. S. Coast and Geodetic Survey. The Colorado River in its lower course flows through a region where many violent earthquakes have occurred in the past, some of them comparatively recently. Scientific men have wondered whether the vast weight of water that will be concentrated along the 115 miles of Lake Mead will put sufficient additional strain on the crustal rock layers to set off disturbances. Mr. Bodle has devoted much study to the question, but stated that the data available are not sufficient to justify a positive answer one way or the other. He suggested that several seismograph stations be set up in the region, so that a better informed watch over the earth's movements may be maintained.

Machine-made indoor earthquakes were used at the Massachusetts Institute of Technology to test instruments intended for use in earthquake regions, called accelerometers. They are so designed that they remain "asleep" until a strong earthquake wakes them up. Then they go into action and write a curve that records what happens. The accelerometers were tested on

"shaking table," which is a platform so mounted that it can be moved back and forth in any horizontal direction, giving a very fair imitation of an earthquake. The tests were made by H. E. McComb, of the U. S. Coast and Geodetic Survey, and A. C. Ruge, of the institute. The records thus obtained will be useful for comparison with records made by the same instruments when they go through a real earthquake.

Earthquake science, or seismology, has a number of practical aspects, and research in it must be pursued without let up because of the importance of certain unsolved problems. This was indicated in an address by Captain N. H. Heck, of the U. S. Coast and Geodetic Survey. Some companies refuse to write insurance in regions with an earthquake history. Insurance rates are always calculated on the statistical chances of a certain type of trouble happening at a given definite place within a unit time period. But although it is possible to say that earthquakes are likely to happen in a given general region, say the Andes or southern Italy, it is impossible to pin them to a definite locality, say Lima or Naples. And guessing at time is even worse; it is absolutely impossible to make an honest and accurate time-forecast of an earthquake. Nevertheless, the data accumulated by earthquake research even now has value in practical affairs. Knowledge that a region is "seismic," that sooner or later a severe earthquake is likely to occur, enables government officers and Red Cross workers to concentrate durable relief supplies at strategic transportation centers and to formulate "plans of battle" to go into effect when the attack comes. Study of instruments and skyscraper models set up on "shaking tables" in engineering laboratories have enabled architects to correct certain weaknesses in specifications for buildings to be erected in earthquake regions. These researches are all in active progress, so that further advances may be expected.

THE "LANGUAGE" OF THE GIBBON

The first photograph records of the "language" of the gibbon, key animal in the evolution of man, have been made this spring in the mountain forests of northern Sumatra by an expedition from Harvard University, the Johns Hopkins University and Bard College.

They are expected to constitute one of the more important aspects of the expedition's first-hand study of the natural behavior and physical character of the Asiatic anthropoids. From the expedition as a whole the group hopes to glean important new clues to man's early development and the jungle origins of his social systems that will aid in unraveling some of the more puzzling problems of human evolution.

To this end the seven American investigators comprising the party are applying modern psychology, sociology and anatomy to their examination of the gibbon's home life, testing primarily the position of the gibbon on the family tree of the anthropoid apes and even on man. Similar to man physically, the gibbon is gregarious and monogamous as well, facts that lead authorities to believe that in his natural habitat they may find traces of

the origins of man's most firmly established institutions, his family and group life.

According to Harold J. Coolidge, Jr., of the Harvard Museum of Comparative Zoology, leader of the group, despite numerous difficulties, including a brush fire that nearly wiped out the base camp on Mt. Angka, investigations have thus far been very successful. It left this country in January and has been in the field since March.

Judicious use of blinds and screens have enabled the scientists to approach within close range of the animals without disturbing them. Detailed photographs of their activities have been obtained in addition to the pioneer phonograph records. These records are unusually clear and are so accurate that when they were played back to the gibbons, the animals responded immediately, varying their reactions as each new call came from the loud-speaker. The expedition hopes to continue these valuable recordings until a complete catalogue of all the major vocal patterns of the gibbon is obtained.

Dr. C. R. Carpenter, of Bard College, who made the recordings, has also conducted detailed observations of sixteen family groups of wild gibbons as well as a dozen captive animals in the camp. Other members of the party, assisted by native hunters, have collected a series of gibbons for study of anatomical and morphological problems. Some of these specimens were obtained in prenatal stages and are expected to be especially valuable in comparative embryology.

Dr. Carpenter is still in Siam and will remain there until the rainy season sets in in July, but the rest of the group have now gone to British North Borneo to study orang-utans, gibbons and proboscis monkeys. Members of this group are Professor Adolph H. Schultz, of the Johns Hopkins University; Sherwood H. Washburn, of Cambridge; J. A. Griswold, of the Harvard Museum; Andrew Wylie, of Washington, and John T. Coolidge, of Milton, Mass., photographer. Various members will later visit Java and Sumatra.

Cooperatively financed by the Carnegie Institution, the Milton and Sheldon funds of Harvard, the Columbia University Council for Research in the Social Sciences, and from several private donations, the studies are expected to provide a much-needed control for laboratory observations made of these animals. Thus the expedition will play an important part in a comprehensive research calling for comparative studies to interpret man's social and physical evolution and those of other important primates.

PRONTOSIL

PRONTOSIL, the new chemical remedy that has already saved thousands of lives and promises to conquer four of mankind's major germ enemies, and its chemical relative, sulfanilamide, were discussed at the meeting of the American Medical Association at Atlantic City. The latest disease to be treated with sulfanilamide is pyelitis, serious and troublesome urinary tract infection for which there has hitherto been no very successful treatment. Cases of pyelitis which were completely cleared up by treatment with sulfanilamide were reported by Dr. Henry F. Helmholz, of the Mayo Clinic, Rochester, Minn. This

was the first report of the use of the new chemical remedy for this disease. Dr. Helmholtz was to have reported results of treatment with mandelic acid, but his results with sulfanilamide were so much better and so spectacular that he made a last-minute change in his paper in order to report the sulfanilamide treatment.

Meningitis, including the particularly deadly variety due to streptococcus infection of the brain membranes, as well as pneumonia, gonorrhea, childbed fever and other diseases caused by streptococcus infection, all yield to treatment with sulfanilamide or Prontosil. Reports of hundreds of similar cases are now ready for publication in the *Journal* of the American Medical Association, according to the editor, Dr. Morris Fishbein.

The chemical is not an antiseptic and does not kill the disease germs. Its action apparently is to keep the germs from growing and multiplying in the patient's body. The body's own fighting forces are consequently able to overcome the infection, and the patient recovers. Sulfanilamide is apparently particularly effective in checking the growth of the round germs of the great "coccus" family. These include streptococci, pneumococci, meningococci and gonococci. These bacteria are the causes of Type III pneumonia, for which there has been no such satisfactory serum treatment as there is in Types II and I; streptococci meningitis, which up to now has always been fatal; gonorrhea, for which there has never been the specific treatment that there is for syphilis; childbed fever, which has killed thousands of mothers every year in spite of all efforts to check it; and the distressing and painful disease erysipelas. All have now been successfully treated by sulfanilamide or Prontosil.

This new chemical remedy was developed by a German chemist, A. Domagk. It was first brought to the attention of physicians generally by the English physicians, Leonard Colebrooke and Meave Kenny. Its first use in the United States was by Drs. Perrin Long and Eleanor Bliss, of the Johns Hopkins University. Drs. Bliss and Long described the precautions necessary in the use of the remedy.—JANE STAFFORD.

THE EFFECT OF VITAMIN B₁ ON BONES

A VITAMIN discovery that sheds new light on gout and may prove a remedy for that ailment was reported by Dr. Martin G. Vorhaus, of New York, before the meeting of the American Medical Association. Cases of this disease were improved by doses of vitamin B₁. Pain and swelling disappear, and even more striking, x-ray pictures of the affected joints show that new bone tissue is apparently formed. Dr. Vorhaus pointed out that this is the first time that any one has ever discovered any effect of vitamin B₁ on bones. Hitherto this vitamin was known only to affect nerves and the utilization of sugar. The discovery of its effect on bones is so new that Dr. Vorhaus and his associates have not yet decided exactly what is the relation between the vitamin and bones. They are reporting sixteen cases observed for longer than three months in order to stimulate others to investigate the problem.

The discovery was made accidentally in treating neuritis with this vitamin, which is sometimes called the

anti-beriberi vitamin because lack of it causes the oriental nervous disease known as beriberi. Some of the neuritis patients, instead of being helped by the vitamin as others had been, experienced severe reactions and were for a time much worse. The uric acid content of their blood rose, and this discovery led Dr. Vorhaus to continue the vitamin treatment in order to learn why the vitamin produced this effect. It turned out that all the patients had gout along with the neuritis, though the gout had not been suspected until its symptoms became acute after the vitamin dosage. With more vitamin dosage, the patients improved greatly, and the uric acid content of the blood dropped back to normal.—JANE STAFFORD.

ITEMS

THE prickly pear, considered a public nuisance in India because of its prevalence, is now being used to create combustible gas having a heating value nearly half as great as ordinary coal gas. Two chemists, B. S. Shrivastava and S. Rangachari, of the Andhra University, are now "cracking" the dried plants to obtain its combustible gases. This means that it is possible to secure a gas almost half as efficient as coal gas whose heating value is generally considered to be about 5,700 calories per cubic meter.

THE enormous bulge in the earth that has its crest in the Himalaya Mountains is responsible for the terrific earthquakes that sometimes rock interior Asia, according to Professor D. Mushketov, of the Leningrad Mining Institute, after extensive expeditions in which thousands of observations were taken. The deep-seated forces push up the crust of the earth in this region as a man in bed pushes up the covers with his knees. Like the covers pulled over the knees, the thick blankets of rock are under tension. They give way from time to time, and then starts the earthquakes. Accurate measurements made by Professor Mushketov show that in the Pamir region the curvature of the earth is much in excess of the average curvature of the earth as a whole.

SOVIET aviation engineers are pushing to completion a semi-rigid passenger airship an eighth of the size of the *Hindenburg*. They are planning to inflate it with helium obtained from natural gas wells in the central district of the USSR. Construction of a plant for the extraction of helium will begin this year. Prospecting has revealed more gas wells carrying helium in other parts of the union. The new airship will have a volume of 880,000 cubic feet (25,000 cu. meters). It will contain sleeping accommodations for sixteen people, salon, buffet and smoking room.

By dropping steel balls through holes in a steel plate, investigators at Queens College, Ont., are testing the theory of probability by actual experiment. The idea is to see how many of the balls will pass through the plate without touching the sides of any of the holes. The results say that the probability of this happening should be .3554. For the first half million balls dropped, 177,700 of them passed through without touching which yields .35557 by experiment.

SCIENCE

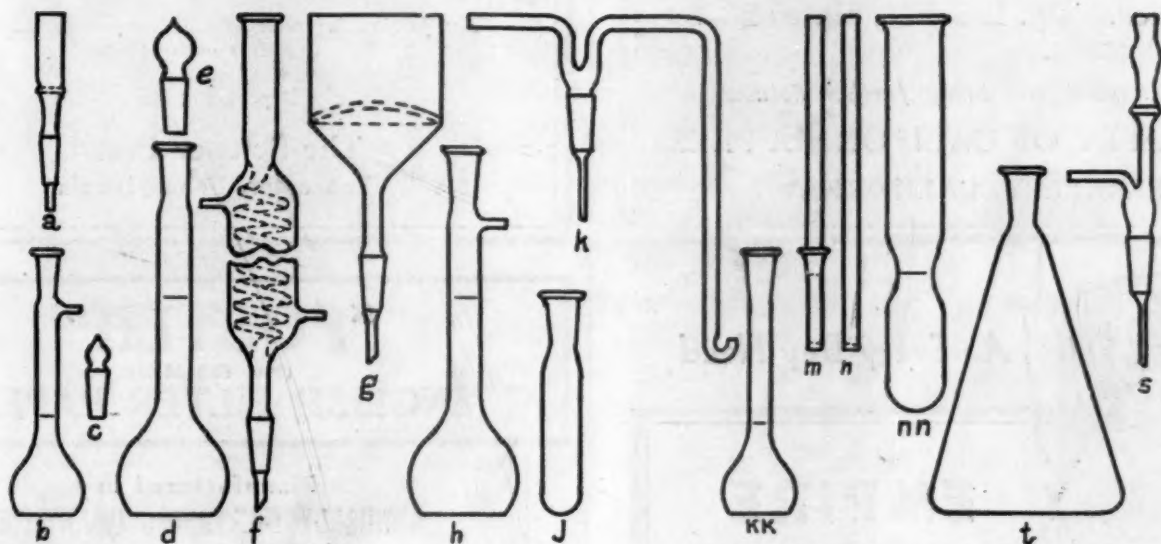
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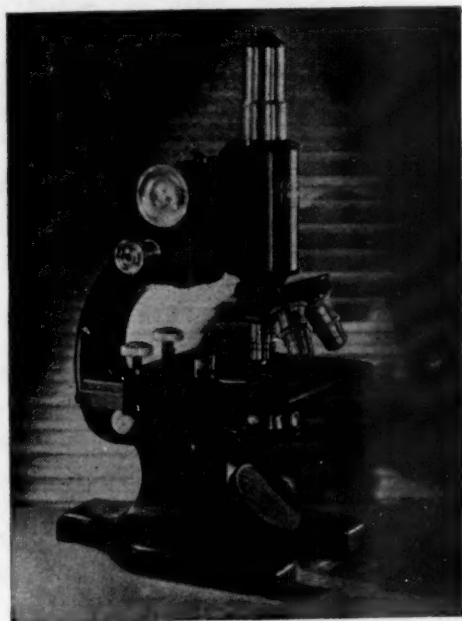
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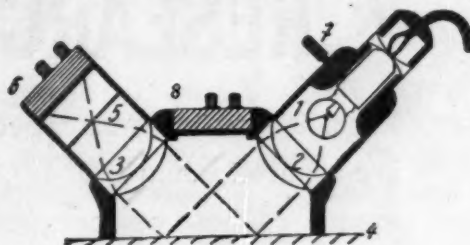


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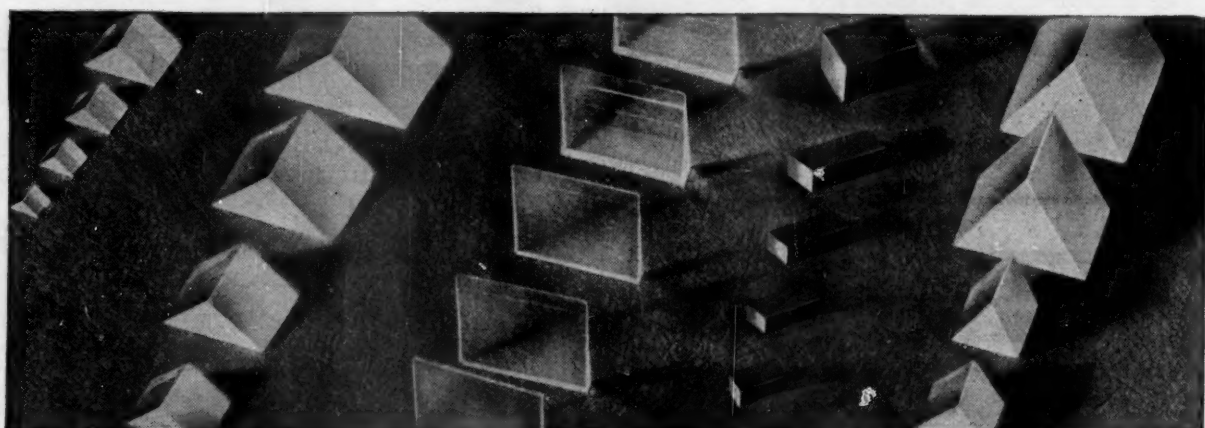
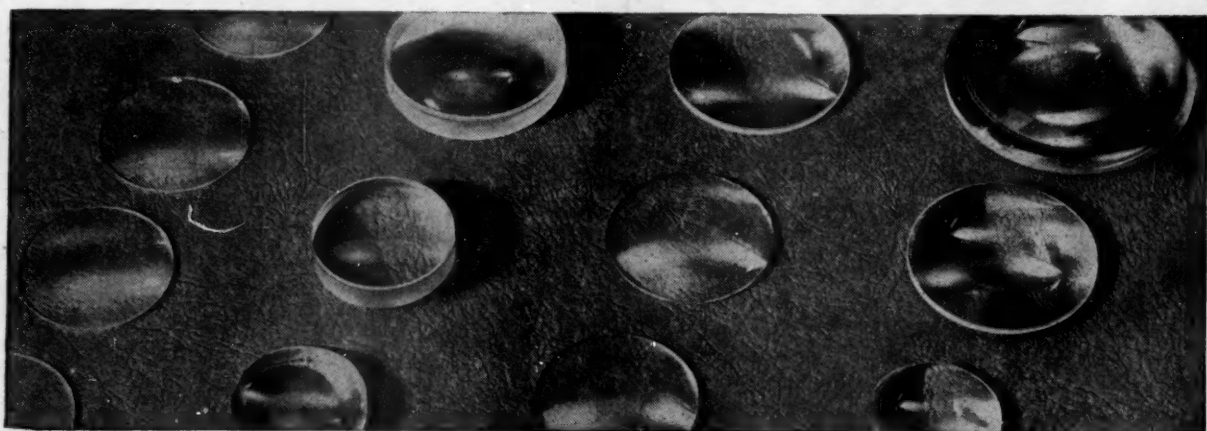


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SCIENCE NEWS

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THE ORIGIN OF THE COSMIC RAY

PROFESSOR ARTHUR H. COMPTON, professor of physics at the University of Chicago, and Dr. P. Y. Chou, of the National Tsing Hua University, Peiping, China, discuss in the current issue of *The Physical Review*, a new hypothesis on the origin of the cosmic ray. It is pointed out that in the present stage of cosmic ray knowledge there is no known act of nature—even the annihilation of the atomic nucleus—which can provide sufficient energy to fit the observed energies of some of the cosmic rays. The only possibility is the primeval explosion that sent worlds and galaxies literally rocking and reeling into space.

Every kind of particle and the packets of energy known as photons would be the debris of such a staggering catastrophe. To account for the known preponderance of electrically charged particles, it suggested that the non-charged photons and neutrons have been lost in space because they could penetrate the magnetic field of stars and galaxies. But these same magnetic fields might trap the charged particles and so produce the observed particle component of the cosmic rays.

The authors acknowledge the expanding universe theory of Abbé LeMaitre as the inspiration for the new hypotheses of the origin of cosmic rays. This is the first report on the subject to appear for some time. For some years investigators have been content to study and obtain more and more experimental data, leaving the fitting together of the pieces to a later time.

Discussing the high energy of cosmic rays and their apparent origin somewhere out in space, the authors write: "If the cosmic rays come from beyond the Milky Way, at a really typical place in intergalactic space the density of cosmic-ray energy would be of the order of 100 times as great as that of starlight. It is thus apparent that either the source of the rays must be a radiator which is very powerful compared with stars as a source of light, or the cosmic rays once emitted must be retained by the metagalactic system instead of being lost as is starlight. Although nuclear processes occurring in interstellar space might result in an adequate total energy, it appears that such processes are inadequate to account for the great energies of the individual cosmic-ray particles."

Concerning the trapping of the electrical particles they ask, "Is it possible that electrically-charged rays emitted by the initial explosion may be deflected by stellar or galactic magnetic fields just as a cosmic-ray electron is deflected by the earth's magnetic field? If so, those particles which would be most probably retained by the metagalactic system would be those with the highest ratio of charge to mass in order, electrons, protons, etc., whereas all neutral rays might be forever lost."

Because, on the hypothesis, the cosmic rays would spend much of their lifetime in intergalactic space they should suffer the "red shift" decay of energy in the same way that light does. If this is true the energies of the cosmic

rays now striking the earth must be much less than those of the rays in the early history of the earth.

A NEW METAGALACTIC CLOUD

WHAT is probably the most extensive "metagalactic cloud" ever discovered, so tremendous that it may easily encompass 50,000 galaxies comparable with our own Milky Way, has been located and photographically studied by astronomers of Harvard University.

Shaped roughly like a narrow stream, it is estimated to be about 50,000,000 light years in length and 20,000,000 light years across. It is more than 100,000,000 light years distant from the earth, however, and despite its great size, its members are visible only through the most powerful telescopes. It is situated near the south pole of the heavens. According to Dr. Harlow Shapley, director of the Harvard Observatory, who announced the discovery, the cloud is of particular interest to astronomers not only because of its tremendous size, but because it is expected to be of much importance in studying the complex space-time-matter relationships in our "immediate" neighborhood, astronomically speaking—that is, out to about 100,000,000 light years. It emphasizes the lack of uniformity in the space distribution of galaxies. Astronomers have for some years been aware of the existence of so-called super-galaxies—clusters big enough to contain several hundred Milky Way systems. Until this most recent find, however, there has been no evidence of galaxies much larger than these—certainly not for any as large as the one just found. The new cloud was discovered on photographic plates taken at the southern station of the observatory during a more or less routine survey of all galaxies brighter than the 18th magnitude. At first it was classified as merely a "major irregularity" in the distribution of faint galaxies in the southern skies. The photographic plates actually show only about 15,000 galaxies, all of them between the magnitude of 16.5 and 18.5, but judging from other super-galaxies it is assumed that many members are too faint to show on the plates and have placed the probable complete census at more than 50,000 galaxies. Astronomically speaking the cloud extends over a region about 40 degrees in length and 15 degrees in width, from near the sky's south pole toward the south galactic pole in Sculptor.

RADIOACTIVE ELEMENTS

In a report to the American Physical Society Professor T. R. Wilkins and Dr. W. M. Rayton, of the University of Rochester, present new evidence which helps make clearer the origins of the missing long-lived parents of the actinium series of radio-elements.

Scientific happenings which make it possible to throw light on the problem are that sometimes the change from one element to another is accompanied by a loss of weight and sometimes merely by a loss of electrical charge without the weight loss. The loss of weight occurs when the nucleus of a helium atom, known as an alpha particle, is

liberated in the radioactive disintegration. Then, the parent atom drops down two whole numbers in the numerical scale which rates chemical element from hydrogen, at one, to uranium at 92.

When electricity is given off by the emission of an electron the atomic number of the element jumps back up the scale by one unit. Thus Uranium I (92) gives off an alpha particle and becomes Uranium X_1 (90). But Uranium X_1 gives off an electron and becomes Uranium X_2 with atomic number 91. Thus in stepwise fashion, but sometimes up and sometimes down the scale of atomic numbers, go the disintegrations of the heavy radioactive elements, of which the best known is, perhaps, radium with atomic number 88. Common, grey and soft lead is the final offspring of all these spontaneous changes and there are four different kinds of lead; radium lead, thorium lead, actinium lead and just lead. The radium, thorium and actinium here mean that it is lead which had each of these specific origins. Plain lead merely means that its origin can not be specifically fixed.

The ability of the radioactive atoms to lose or take on weight at various stages means that there will frequently be two or more varieties all having the same chemical properties but slightly different masses even though they may have the same atomic number rating. Thus Uranium X_1 and its three isotopes all have atomic weight of 234. One has an atomic number of 90, another is number 92 and two are number 91.

While chemical methods are not sufficiently exact to permit distinguishing between all these varieties, other methods, and in particular, the range with which alpha particles are emitted, serve as experimental checks.

Drs. Wilkins and Rayton have studied the alpha particle ranges as their method is seeking actinium's "lost parent." The investigation also throws much needed light on the way alpha particles are emitted from the nucleus of atoms; a problem which has bearing on the much-studied and important field of the constitution of the inner cores of atoms.

A previously-unfounded isotope of uranium has been indicated, at least tentatively, which might well serve as the parent for the now-orphaned series of actinium radioelements.

A SCIENCE OF HUMAN BIOLOGY

A SCIENCE of human biology, broad enough in its scope to synthesize knowledge of man's mental and spiritual sides as well as of his physical nature, ought to be evolved within the next century if civilization is to survive—perhaps even if the human race itself is to escape extinction. This was the concluding note of an address by Professor Raymond Pearl, of the Johns Hopkins University, at the celebration on June 17 of the hundredth anniversary of the founding of the University of Michigan.

The necessity for such a science of social synthesis has been thrust upon us, Professor Pearl said, by the long rides science has taken in putting more wealth and power into the hands of men, while other aspects of our evolution have remained stagnant. We have advanced enormously in power, and little or not at all in wisdom

and goodness. So the very advances we boast of in material things make our development so lopsided that it threatens to crash and end, as many other lines of great but unbalanced evolutionary development have ended in the past.

Fumbling attempts at such unification of human knowledge and striving have been made hitherto by politicians and clergy—with results not particularly distinguished. They are not wholly to blame for lack of success, either; the prerequisites of real knowledge of the whole nature of man has simply not been met—the data do not yet exist. That is one of the chief challenges to the scientific man: both by natural aptitude and training he is best equipped to obtain such data; and he should therefore seek and find them.

Professor Pearl invited his hearers to look backward over the hundred years since the founding of the university: Pasteur, Lister, Huxley, most of the great leaders of the scientific revolution of the nineteenth century, were still children then. With a record of so great achievement in so short a time there is no reason for supposing that the world will not continue to go ahead. As a practical matter, he expressed the belief that the universities, rather than specially founded independent institutions, offer the best environments for scientific research. That research institutions unparented by universities have been called into existence at all he regards as a symptom of the departure of modern universities from their original tradition; but this, he thinks, is a passing phase, and the universities will soon come into their own again as homes of research.

THE PARTICIPATION OF ENGINEERS IN NATIONAL AFFAIRS

THE electrical engineering profession was urged to participate actively in national projects and events in which it has special knowledge at the recent meeting in Milwaukee of the American Institute of Electrical Engineers. Frank R. Innes, the western editor of *The Electrical World*, made the recommendation as he disclosed a recent poll of engineers to see if they wished their societies to enter actively into topics of national interest. That the engineers wished, by a great majority, to undertake this greater social responsibility was evidenced by the poll reported.

Mr. Innes charged that engineers have talked much in vague, nebulous terms that belie their scientific training, about social responsibility as it affects engineers. The time for action is at hand, he indicated, and suggested that the first topic of study by a committee of electrical engineering societies might well be the federal water power program. Specifically, electrical engineers should investigate criticisms of the program that are now current, namely:

(1) That the only markets available for government plants are those which would take away existing utilities, or that most government plants are so remote from large markets that it can be said that no markets exist for them.

(2) That the cheapest electricity to-day comes from fuel plants near existing markets; and that it costs less

to haul coal for fuel than it does to transmit the electric power from a distant source.

(3) That water power electricity, from an efficiency standpoint, is almost a closed art, whereas electricity from fuel plants has the greatest chance for future economies.

(4) That building large power plants may aggravate employment problems, reducing labor costs in production and removing it almost entirely from the field of transportation.

(5) That financing periods of fifty years, needed for the giant government hydro-electric projects, appear to be indefensible in the present age of technological progress when to-day's best machines may be obsolete in the next few years.

INSULIN IN THE TREATMENT OF SCHIZOPHRENIA

DR. JOSEPH WORTIS and Karl M. Bowman, of Bellevue Hospital, New York, reported at the closing session of the American Medical Association, that more than one thousand mental cases have been restored to health and sanity by treatment with insulin.

The treatment consists, essentially, of giving the mental patient enough insulin to produce shock. This is a much larger dose than is given to control diabetes. The treatment was originated by a young Austrian physician, Dr. Manfred Sakel, in 1930. Since then, Dr. Wortis said, it has been used in fifty hospitals and universities throughout the world from Korea to Iceland and from Edinburgh to Galveston. The results are "substantially positive and confirmatory." Dr. Sakel claims that nearly three fourths of the patients who have been ill less than six months recover completely, while good results are obtained in slightly less than half of those who have been ill several years.

The particular disease for which insulin shock is used is called schizophrenia. No one knows what causes it, but insulin treatment may give the clue on further study. Results from this treatment already show that the cause is probably a defect in brain structure or chemistry, and not mental or psychological, as some psychiatrists have held.

The treatment of this disease by insulin shock, produces improvement that outruns anything produced by any other kind of treatment, in the opinion of Drs. Roy G. Hoskins and D. Ewen Cameron, of the Worcester, Mass., State Hospital. These two physicians were the first to take up the insulin shock treatment of schizophrenia in the United States. They and the Bellevue doctors both reported their results, pointed out various points in technique and explained that the treatment must only be given in a well-equipped hospital under the supervision of a trained psychiatrist ready to meet the dangerous emergencies that may arise. Chief of these is the possibility of the patient succumbing to the shock unless proper restorative measures are at once instituted.

Striking changes in the behavior of the patients, including a return to a quiet, orderly, normally active life, with ability to concentrate and loss of hallucinations,

were reported by Drs. Hoskins and Cameron.—JANE STAFFORD.

ITEMS

SUGAR CANE leaves can form cane sugar when they are detached from the stalk and kept in the dark, supplied with the two simpler sugars, glucose and fructose, or with either one of them alone. Experiments developing these points, performed by Dr. Constance E. Hartt, research plant physiologist for the Hawaiian Sugar Planters' Association, give further support to the theory that conversion of simple into complex sugars can take place in leaves.

LIKE a wartime listening post is the instrument for detecting boring insects in timber devised by F. M. Colebrook, of the National Physical Laboratory at Teddington, England. It consists of a soundproof box in which the suspected sample is placed, a microphone and amplifying setup, and headset or loudspeaker. Mr. Colebrook describes the gnawing of deathwatch beetle larvae as "a kind of muffled and intermittent rattle."

NEW land is being added, slowly but surely, to the map of the United States. The mangrove bushes along the coast of Florida are doing it, according to Professor John H. Davis, of Southwestern University. Professor Davis has been making a special study of this subject, from personal observations, examination of old maps, and comparison of newest air-survey photographs. The red mangrove, which grows in salt water, has numerous roots which catch and hold silt and clay. As the deposit becomes higher, the red mangrove is supplanted by the white and black varieties which grow better on the higher soil. On decay, the mangrove remains form peat formations which air further in the land-building process. Experimental plantings of mangroves have been made along the Florida coast so that further study of their rôle in land-building may be investigated.

A NEW antitoxin which promises to be a specific cure for gonorrhea, was reported by Dr. T. Anwyl-Davies, of St. Thomas's Hospital, London, at the conference of State and Provincial Health Authorities of North America, meeting at the U. S. Public Health Service in Washington. The new antitoxin is still in the experimental stage, but the results already obtained seem to encourage that it will be tried by the U. S. Public Health Service at its venereal disease clinic at the U. S. Marine Hospital, Stapleton, N. Y. Dr. Anwyl-Davies reported excellent results in about half the 157 cases treated and good results in another quarter of the cases. "Cures" were effected in 36 cases which have been observed for over three months. Two of these were cured in 16 days, while other cases took as long as 8 weeks. The antitoxin is equally effective in acute and chronic cases, with and without complications. It differs from other antitoxins previously tried in this disease in the way it is prepared. Instead of being made by injecting the gonococcus directly into horses, the toxin produced by the gonococcus is injected into horses and the serum of these animals used for the antitoxin.

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